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TRANSACTIONS

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION.

MAY, 1887.

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TRANSACTIONS

OF THE

~~FOURTH ANNUAL MEETING~~

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION

HELD IN THE CITY OF BALTIMORE,

MAY 31 AND JUNE 1, 1887.

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MINUTES.

THE fourth annual meeting of the American Climatological Association was held in Baltimore, Tuesday and Wednesday, May 31 and June 1, 1887, in the new Physical Laboratory of Johns Hopkins University.

The President, Dr. Frank Donaldson, occupied the chair during all the sessions, presenting his address at the opening session.

There were thirty-seven members present.

Papers were read by Drs. J. R. Leaming, of New York; R. G. Curtin, of Philadelphia; Frank Donaldson, Jr., of Baltimore; F. C. Shattuck, of Boston; E. T. Bruen, of Philadelphia; B. F. Westbrook, of Brooklyn; J. B. Musser, of Philadelphia; A. Y. P. Garnett, of Washington; A. L. Loomis, of New York; E. L. Trudeau, of Saranac Lake; W. C. Van Bibber, of Baltimore; Walter Platt, of Baltimore; A. C. Peale, of U. S. Geological Survey; and F. F. Smith, of St. Augustine. Papers by the following gentlemen were read by title, in the absence of the authors: Drs. F. H. Bosworth, of New York; Boardman Reed, of Atlantic City; H. S. Orme, of Los Angeles; Charles L. Le Roux, of Pass Christian; and S. E. Solly, of Colorado Springs, Col.

There was considerable discussion of the subject matter of the various papers read.

The private business of the Association was transacted at 3 P. M. Wednesday.

The minutes of the last private session were read and approved.

The Treasurer's report was presented and audited.

The Nominating Committee, consisting of Drs. Shattuck, Bruen, Westbrook, Geddings, and Ford, reported the following officers for the ensuing year, who were unanimously elected:

President.—Dr. A. L. Loomis, of New York.

Vice-Presidents.—Drs. A. Y. P. Garnett, of Washington; and James T. Whittaker, of Cincinnati.

Secretary and Treasurer.—Dr. J. B. Walker, of Philadelphia.

For annual vacancy in Council.—Dr. R. G. Curtin, of Philadelphia.

The President called attention to the death of Dr. E. Darwin Hudson, of New York, since the last meeting; and Dr. J. C. Wilson offered the following, which was adopted:

Resolved, That the Secretary be requested to enter upon the minutes of

this meeting a note making record of the recent death of E. Darwin Hudson, M.D., one of the original members of the Association and an earnest and efficient promoter of its objects; of our recognition of his ability and enthusiasm in the cause of scientific medicine, his high personal character, and the importance of the work he had already achieved when, at the beginning of the most useful period of life, he, all too soon, ceased from his labors.

Dr. Loomis, representing us in the Committee of Conference for a conjoint session of the various special medical associations, reported a proposed conjoint session or medical congress to be held in Washington in September, 1888, each association to hold its individual sessions and to meet in congress at certain sessions. The report requested our Association to appoint a representative and an alternate. On motion, Dr. Loomis was chosen Representative, and Dr. Donaldson, Sr., Alternate.

The Council reported that the *New York Medical Journal* had declined, "from abundance of other material," to renew their arrangements with this Association for the publication of its *Transactions;* and suggested that the Association publish its own volume of *Transactions*, and permit authors of papers to make such individual arrangement for their journalistic publication as they may think proper.

The report was adopted and the dues for the year fixed at five (5) dollars, to meet the requirements for the increased expense.

The following gentlemen, recommended by the Council, were elected members of the Association:

Dr. A. L. Gihon, U. S. N.
Dr. W. D. McDougal, of San Jose, Cal.
Dr. A. C. Peale, U. S. Geological Survey, Washington.
Dr. G. Wilds Linn, of Los Angeles, Cal.
Dr. J. P. Widney, of Los Angeles, Cal.
Dr. Frank F. Smith, of St. Augustine, Fla.
Dr. F. P. Henry, of Philadelphia.
Dr. James J. Levick, of Philadelphia.
Dr. Thomas J. Mays, of Philadelphia.
Dr. Thomas C. Latimer, of Baltimore.
Dr. J. Carey Thomas, of Baltimore.
Dr. Walter Platt, of Baltimore.
Dr. D. B. St. John Roosa, of New York.
Dr. S. E. Solly, of Colorado Springs, Col.
Dr. D. H. Dougan, of Denver, Col.
Dr. S. W. Langmaid, of Boston.
Dr. E. C. Morgan, of Washington, D. C.
Dr. S. H. Chapman, of New Haven, Conn.
Dr. S. A. Fisk, of Denver, Col.

The following amendment of the Constitution was unanimously adopted: "Any member of the Association absent from the meetings, in person or

by contributed paper, for three (3) consecutive years, without sufficient cause, may be dropped from the list of members by vote of the Council."

A vote of thanks of the Association was tendered to President Gilmore, of the Johns Hopkins University, for the use of the hall of their new Physical Laboratory for the meeting.

The Association then adjourned private session.

J. B. WALKER,
Secretary.

At the close of the afternoon session on Wednesday, the members visited, by invitation, the Hospital of the Johns Hopkins University, under the guidance of Dr. J. S. Billings.

Under the chairmanship of Dr. Frank Donaldson, Jr., a sumptuous banquet was provided at the Rennert House, on Wednesday evening, which was markedly successful both in the numbers participating and the social features of the occasion.

OBITUARY.

On May 9, 1887, Dr. E. D. Hudson, Jr., a member of the Council and an active worker in the Association, died of pneumonia after a few days illness He was born at Northampton, N. Y., in 1843. In 1867 he was graduated from the College of Physicians and Surgeons, New York, and subsequently entered Bellevue Hospital, spending the usual time as interne in that institution. At the time of his death he was Professor of General Medicine at the New York Polyclinic and Visiting Physician to Bellevue Hospital and St. Elizabeth's Hospital. He was a member of the Academy of Medicine, of the Medical Society of the County of New York, of the Pathological Society, and of the New York Physicians' Mutual Aid Association.

Formerly, as Professor of the Practice of Medicine in the Women's Medical College in New York, and later in his Professorial Chair at the Polyclinic, as well as the Societies of which he was a member, he was an active and untiring worker. After many years of persistent labor, he was beginning to reap the reward in a remunerative practice which was to a large extent consulting.

Dr. Hudson was not a voluminous contributor to medical literature, but what he did was done well, and his papers bore evidence of careful research and accurate observation. His book on *Physical Diagnosis*, which appeared after his death, is a model of brevity and conciseness without the sacrifice of clearness and fulness.

Space will not permit me to consider at length the circumstances of his life, but his character was in some respects worthy of study. If he had genius, it was the genius of hard work and persistent endeavor. To the consideration of any question with which he had to do he brought the calmness which showed no lack of force but rather the control of a well-balanced mind. When a man of full years and whose life-work must necessarily be nearly done is called away, however much we may miss him, we yet feel that the laws of nature have but had their course. But when one in the prime of life dies, whose labors are just receiving recognition and whose future holds out the bright promise of reward, it is a sad reflection and tinged with bitterness that he should be so suddenly taken away.

D. M. Cammann, M.D.

PRESIDENT'S ADDRESS.

By FRANK DONALDSON, M.D.,
OF BALTIMORE.

My first duty, gentlemen, is the pleasant one of cordially welcoming you to the Fourth Annual Meeting of the American Climatological Association. I am glad of the opportunity of congratulating you on the success of our organization. The volumes of our transactions have been extensively circulated, and everywhere favorably received. The medical press has reviewed them as containing valuable and instructive articles. The objects of this Society, as expressed in the second article of our Constitution, are "the study of Climatology, Hydrology, and Diseases of the Respiratory and Circulatory Organs." The Association has a wider and broader scope than its name implies. These objects have been carried out, and we have had contributions giving us very valuable information in regard to the many health resorts of this country, including those in the mountainous regions of different altitudes, the inland retreats, and finally the seaside places. We have had before us reports of their advantages and of their disadvantages in the treatment of disease.

Perhaps our most important contributions have been in relation to the effects of these various climates upon respiratory diseases, especially upon pulmonary phthisis, a disease which is recognized as the scourge of civilized life. It deserves from us the attention it has received, for it is the most generally distributed and most fatal of all diseases, being the cause of about one-seventh of the whole mortality. It includes among its victims fully one third of those who die in active middle life.

Our contributors have, by their instruments of precision, furnished us with important data assisting us in the delicate question of making a proper selection of climates for our patients in the different stages of phthisis. They have given us clinical illustrations of the effects of these several climates upon this intractable disease.

It is satisfactory to have statistical evidence that there has been an appreciable decline in the death-rate of pulmonary tuberculosis. In most of our large cities, heretofore, the death-rate from this disease has been from fourteen to fifteen, and, in some of them, as high as seventeen per cent.

We have the authority of Longstaff[1] in stating that there has been in England a lessening in the death-rate from phthisis at every age, with some insignificant exceptions in both sexes, the decline being for males fourteen per cent., and for females twenty-two per cent. For both sexes the decline was greatest—twenty-eight per cent.—between the ages of fifteen and twenty, where deaths may be considered, in an economic sense, the greatest loss, since the individual of that age has been supported by society for a number of years, but has done little in return. The decline has been not much less among both males and females at all other ages below twenty-five, varying from eighteen to twenty-six per cent. The lives saved amounted to 13,966 males and 6806 females; not less than 2885 males and 4233 females were of ages from fifteen to thirty-five—that is, among the most useful to the community. Must we not, therefore, credit curative and preventive medicine with another triumph, the saving of many valuable lives?

Dr. George Derby, of the Massachusetts State Board of Health, gives us the gratifying fact that there is a marked diminution in the phthisis death-rate in that State, an annual gain, in each 100,000 of the population, of 54 lives—this amounts to a saving of 688 in each year. The improvement seems still to be going on. We claim that with the advance that has of recent years been made in our knowledge of the nature of this disease, especially of its pathology, etiology, and the effects of curative agents, that the mortality will diminish from year to year. M. Barth has shown from the post-mortem records of the Salpêtrière Hospital that, of persons dying over sixty years of age of other diseases, fifty-one per cent. had in their lungs evidences of their having had phthisis, which had been healed. Assuredly these facts should encourage us and urge us on with our good work. We must continue to collect all possible information having a bearing upon the nature and curability of tuberculosis, for the loss of life from it is still appalling, and the hereditary form when developed offers the least prospect of recovery.

Such being the case, I need offer no apology to the Association for asking their attention for a brief study of

[1] Journal of Statistical Society, London, June, 1884.

Heredity in Tuberculosis and its Prophylactic Treatment.

That there exists an hereditary predisposition to pulmonary tuberculosis is universally admitted. As far back as the time of Hippocrates, it was so recognized. Of the two hundred and ten physicians interrogated by the State Board of Health of Massachusetts, only one denied that consumption was caused or promoted by hereditary transmission.

Dr. R. Thompson gives an account of 80 families of consumptive parentage, of which there were born 385 children, of whom 194 became phthisical and 37 died in childhood, leaving only 154 exempt. Every one is familiar with instances of the development of phthisis from hereditary influence. Life insurance companies daily reject applications where there have been evidences of such proclivity. From the statistics collected by Fuller, Pollock, Walshe, and Theo. Williams, it is fair to state that 30 per cent. of all the cases met with are of the hereditary type. If grandparents' records be included, the proportion will run up to 48 per cent.

It has been found that the hereditary influence of the mother is far greater than that of the father, as might naturally be supposed, as the father's impression is made only at conception, whereas the mother's commences with the ovum and continues through uterine gestation. Again, family predisposition is much more common among women than among men, the proportion being 59 per cent. of women to 37 of men. Statistical tables show that in males the development of hereditary phthisis is earlier, the average age being $24\frac{64}{100}$ years, whereas in acquired phthisis the average age of the attack is 32 years. Hereditary influence is stronger for the immediate than for remote ancestry, except in the rare instances of atavism.

Etiology and Pathology of Phthisis.

For the elucidation of our subject and preliminary to the consideration of what constitutes this heredity, we must, however hastily, look into the modern views of the general pathology of tuberculosis. Indeed, we cannot overestimate the importance of this etiological question in the study of every point connected with this disease.

To Laënnec's genius, in addition to his great discovery of auscultation, we owe the doctrine of the unity of phthisis. He recognized the fact that, notwithstanding the apparently different anatomical conditions found in the pathological investigations of consumption, from

Bayle's granulations to the cheesy masses and scrofulous glands, that they were all varying manifestations of one disease. Men who followed him, especially Virchow, disputed this view and pointed to the histological points of difference as irreconcilable to their being one and the same disease. Virchow showed that caseation could result from ordinary inflammation, which was not a tubercular process.

Tubercle was dissected and examined by high magnifying lenses, which showed the so-called tubercle corpuscle with its small and its giant cells, which were supposed, by Wagner and others, to be characteristic of the disease. They mistook tubercle, the product of disease, for tuberculosis, the disease itself. The specific nature of tubercle, believed in by Laënnec and others, was first demonstrated pathologically in 1857, by Buhl, who pointed out that an outbreak of tuberculosis was almost always attributable to the previous existence of caseous matter somewhere in the body.

The next step in advance was made in 1865, by Villemin, who demonstrated that caseous matter introduced by inoculation into a healthy animal produced tuberculosis, and that, therefore, the tubercular virus dwelt in caseated products. This was a startling discovery, and its announcement from the chair of the Pathological Society of London, by Mr. Simon, created a sensation, for, if it was true, it established the belief, long held by many from clinical observation, that phthisis was a contagious disease. Numerous experiments were made by Lebert, Wilson Fox, and Burdon-Sanderson, and although Villemin's results were confirmed, yet it was claimed that inoculations of muscle, pus, and other matters, even inert inorganic substances and setons and threads, would produce like results.

It may be well here to state that further experiments, by thoroughly competent observers, have shown that these conclusions from inoculations with non-tubercular matter were fallacious whenever due precautions were taken to use perfectly clean instruments and vessels, and to exclude all tubercular animals from the neighborhood of those under operations. Under these conditions inoculations did not produce tuberculosis. In drawing their conclusions from the results of the inoculation of pus from pyæmic patients, there is an obvious danger of a fallacy creeping in, as the patient in any given case may already have been the subject of tubercular disease. Two of the four of Dr. Sanderson's cases were from patients suffering with strumous disease of bone.

Cohnheim, who, with Fränkel, instituted some of these experiments with non-tubercular substances, for some time questioned the accuracy

of Villemin's results, but afterward became a firm believer in the doctrine that only tubercular matter could, by inoculation, produce tubercular disease. The fact is, however, that these experiments made before Koch's discovery are of little value. It was natural that there should be such incredulity in regard to Villemin's experiments. Klebs and Cohnheim boldly defined tuberculosis as an infectious specific disease. It is unnecessary, before this audience, to cite the numerous experimental researches which amply confirmed Villemin's views, and finally culminated in Baumgarten's and Koch's discovery of the tubercle bacillus, a pathogenic microörganism which they claimed was the producing cause of tuberculosis and the potent factor in the transmission of the disease by inoculation or by contagion. Baumgarten pointed out the bacillus, but he did not devise a method of demonstrating it. Koch, by a special process of staining, showed the presence of the microbe, and in 1882 communicated the results of his two hundred and seventeen experiments to the Medical Society of Berlin. These pathologists claimed that this pathogenic agent of tuberculosis was a specific bacillus, differing from almost all other bacteria in size, form, and its chemical behavior with staining substances. They reëstablished, on a sure foundation, Laënnec's doctrine of the unity of phthisis.

Five years have elapsed since the contagium of tuberculosis was isolated. A great many observers have devoted their attention to the relation of the tubercular bacillus to human tuberculosis. The testimony of nearly all is confirmatory of the statement of Koch, that the tubercular deposits in human tuberculosis contain the now well-known bacilli, distinguished by their morphology and chemical reactions from other kinds of bacilli.

The most important question is: Can tubercular disease be produced by the inoculation of anything but matter containing tubercle bacilli?

I must not take up your time longer than simply to mention some of the experiments instituted to test this question. Lawson Williams reports sixteen inoculations with putrid muscular fibre, with negative results. Dr. Watson Cheyne experimented by introducing vaccine lymph, pyæmic pus, and various inorganic materials into the abdominal cavity of animals; he also inserted setons. He did not succeed in a single instance in producing tuberculosis. Salomonsen introduced a variety of substances of non-tubercular nature into the anterior chamber of the eye, with negative results. Baumgarten inoculated with a great variety of animal substances, such as carcinoma, fungi, cheesy matter from different sources, with negative results. Cohnheim and Fränkel's

experiments with non-tubercular substances, when repeated in Kiel and Breslau, gave no cases of tuberculosis. Salomonsen repeated his experiments on an extensive scale with non-tubercular materials, chiefly with the products of inflammation, with absolutely negative results. Cohnheim, before he died, became an ardent supporter of the view that tuberculosis was produced only by a specific organism—the tubercle bacillus.

Many, at first, were of the opinion that the tubercle bacillus would not settle and grow in healthy living bodies, but only in pathologically altered tissues. Thence they inferred that the bacillus was not the cause of the phthisis, but followed it. While it is true that the bacillus takes hold better when tissues are weakened by disease, yet there is abundant evidence that, as healthy animals when inoculated succumb to the disease, so human subjects rapidly yield to the bacillary poison, as seen in acute miliary tuberculosis, when previously they had been in perfect health. It has been suggested that, perhaps, some other pathogenic substance adhered to the inoculated material, and the actual infective virus might reside in it and not in the bacilli. It has been now proven over and over again, that unless the bacilli are present there is no inoculation. Some deny that the process is primarily mycotic, and assert that, first of all, there are in the lung tissue chronic infiltrations, innocuous and non-specific, which afford to the microbe, incapable of development in the normal lungs of healthy individuals, the possibility of settlement and propagation, and thus, benign lung affections are converted into the virulently fatal process of strictly tubercular phthisis. This sceptical spirit is dying out, and Koch's bacillus is now believed by many who once doubted, to be the essential factor of tuberculosis and its manifold lesions. The search for its presence in the sputa, not long since looked upon as a craze, is already taking a prominent and proper place as a supplemental and trustworthy help to diagnosis, and must be so employed.

Tubercle bacillus is never present in the sputa of non-tubercular disease, and observations have shown that bacilli are rarely present in the lungs when absent from the sputum.

By the discovery of this microbe as peculiar to this disease, and almost constantly to be found in the expectoration of phthisical patients, Koch has made the work of sputum examination incumbent upon physicians and no less important than the use of auscultation and percussion. Greater certainty can thereby often be attained, for we are all familiar with the fact that the physical signs of early phthisis are frequently equivocal and undecided, varying from com-

pletely negative to feebly affirmative diagnosis. Indeed, in many cases the most accomplished auscultators may be in doubt. Although in the early stages of bacillary phthisis the temperature is generally raised, yet the presence of bacilli is not necessarily associated with fever. We all know that caseous softening and breaking down of the lung may occur without cough. There may be, also, tuberculosis of the lung with but little loss of body weight, whereas the presence of bacilli in the sputa is conclusive.

Koch has found, in phthisical cavities, an organism called micrococcus tetragonus, which is pathogenic for many of the lower animals and which he thinks may aid in the destructive processes in phthisical lungs. The microörganisms of suppuration, such as the staphylococcus pyogenes aureus and albus, are frequently found in phthisical cavities; their presence is to be regarded as secondary and inconstant; but, when present, they may doubtless aid in the changes in the lungs.

It may be safely said that all attempts to discredit the existence of these bacilli, or to assign to them inorganic properties, have entirely failed. We must now accept this particular microörganism as a necessary factor in the causation of tuberculosis. The bacilli are now known to be present in the pulmonary cavities of all cases of true tubercular phthisis. It must also be admitted that this same microbe can be detected in the sputum of nearly all cases of this disease, at some stage or other of the patient's life. They have been found in the lesions of artificial tuberculosis of animals, and in acute miliary tuberculosis and phthisis in the human subject. They are more abundant in artificial tuberculosis, and less abundant in tuberculous diseases, which include not only acute miliary tuberculosis and phthisis, but also scrofulous glandular and joint affections, and even lupus. (1884, Percy Kidd.)

Spores.—Koch insisted that the spores are extremely resistant bodies. He found that, in certain cases, caseous matter, apparently containing no bacilli, was still infective, and, when inoculated, set up tuberculosis, with a copious development of bacilli. He supposes that, in such cases, the caseous matter contained the spores—*i. e.*, potential bacilli—which only required a suitable nidus for their evolution into mature bacilli. This may afford an explanation of the absence of the bacilli in many nodules.

In this connection I would refer to the observations of Baumgarten and Arndt (*Centralbl. f. d. med. Wissen.*, No. 62, 1883), which are very important. They introduced tubercular material into the anterior chamber of the eye, and excised the organ at various dates. At first

the only changes noticed in the tissues were those connected with the cicatrization of the wound and the encapsuling of the foreign mass; on the second day an increase in the number of the bacilli was distinctly visible. Gradually the bacilli spread themselves through the young granulation tissue around the inoculated mass; then they extended along the cicatricial tissue into the cornea, and also reached the iris. Baumgarten says that isolated bacilli may be seen on the fifth day in the iris and cornea, some free in the intercellular areas, and others in the connective tissue cells; in both cases without the slightest deviation from the normal histological appearance of the tissues. On the sixth day, in those parts of the tissue where the bacilli were numerous, newly formed cells of the epithelioid type were noticed. The troops of invading parasites increased daily. The nearer to the point of inoculation, the more thickly did they lie; the further off, the more thinly; and in those places where they were sparsely scattered, the tissue presented no histological changes. It would seem, therefore, according to Baumgarten's observations, that the production of the characteristic tuberculosis lesion is, as it were, the reaction of the tissues under the peculiar stimulus of the growing bacilli; and that since, when compared with most known microörganisms, the development of the bacillus tuberculosis is shown, so the reaction of the tissues is of the chronic type. They have been found in the walls of small pulmonary veins, and, in one instance, in an arteriole. There can be no doubt that the bacilli are disseminated in part by the lymphatics of the lung. The first infection comes through the atmosphere, and is thus largely supplemented by aspiration into the lungs of the contents of the cavities. Watson Cheyne suggests that, in caseous pneumonia, the virus is inhaled into the individual alveoli. It may be dependent upon the stage of development of the nodules.

Bacilli, or their spores, may remain shut up for months or years in a caseous mass, until some other agency begins the chemical processes necessary for the solution of the caseous matter. Most clinical observers have met with cases of very early pulmonary phthisis associated with great swelling (tuberculous) of parts of the larynx, without any obvious ulceration. A typical instance of this is presented in the so-called turban-shaped thickening of the epiglottis found sometimes at an early stage in the development of laryngeal phthisis. This swelling of the mucous membrane may be unassociated with any visible ulceration; there may, however, be some light abrasions.

Contagion.—Thus it is demonstrated that tuberculosis is a parasitic

disease. We are now forced by the pathological investigations of Ruhl, by Villemin's experimental inquiries, by Koch's demonstration of the bacilli tuberculosis, and by confirmatory experiments instituted in pathological laboratories here and abroad, to believe in Laënnec's view of the unity of phthisis—which includes all its manifestations, acute and chronic: tubercle, caseous pneumonia, miliary tuberculosis, and fibroid phthisis; the tubercle bacillus being the origin of all these apparently different pathological changes, whether produced by inoculation, or by spontaneous development—science now not only shows the existence of the microbe, but also makes clear many points in its natural history. The microscope cannot create objects, it only reveals them. By its aid the behavior of the bacillus is watched, and its effects examined. It causes the nodules known as tubercle and local inflammatory points. It is in the nature of an epiphyte, in that it not only sets up local disease, but produces the specific disease. The putrefactive organisms, with the aid of the physical conditions of heat and moisture, assist in caseation. We cannot tell why the microbe thrives in some persons and not in others, why it increases at one time and not at another. But we cannot longer question its contagiousness, for it has been demonstrated that it may be communicated by one being to another.

From clinical observation, many practitioners believed in the contagious nature of pulmonary phthisis long before these recent discoveries. In many instances individuals, especially wives and husbands, apparently contracted the disease from each other. That many were exposed, and did not take the disease, ought not to militate against the belief of its being contagious, for we are all familiar with the fact that this is true of all universally acknowledged infectious diseases, including the exanthematous fevers. There are different methods of infection in different diseases. Then, again, the susceptibility of individuals varies so much; some rarely take any, even after much exposure; others, on the contrary, on the slightest contact readily taking infection. Theories and probabilities have now disappeared to give way to certainty. Inoculation and reproduction of the infecting principle are shown by the mode in which the disease begins, in most of the cases as a local disease, in the cells of the smallest bronchi, in one or two circumscribed spots only in the apex of the lungs, a favorite lodging-place. From this point it extends gradually to the periphery. When ulceration takes place, the air in respiration, passing over it, conveys the virus elsewhere, causing other inoculations, just as if it had been inserted with a hypodermic syringe. It

does infect the whole organism. The ordinary method of contagion is through the dried sputum containing the bacilli—which may remain dormant for a long time without losing their vitality or asserting their power of evil.

Fortunately, the microbes do not grow and spread outside of living bodies, for their multiplication requires a temperature of from 85° to 105° F. As parasites, they preserve their virulence for a long time when dry and pulverized. True tubercular disease is found in almost every country of the earth. It appears very often in localities and under circumstances least expected. We are told that surfaces buried for many years under the snow in the Arctic regions, when exposed for a short time to the sun's rays, show vegetable growths. In like manner, these destructive bacilli tuberculoses seem to exist everywhere. As there is no such thing as spontaneous generation, they must have come from some living animal source. We cannot wonder that they are found in large cities, ready to assert their destructive powers whenever they meet the proper soil. The sputum is expectorated in the street, or in the dwelling, and is taken up by the winds, and inhaled into our lungs. The bacilli or their spores lodge in the air-passages, the lungs or the larynx, the nose, the pharynx, or in the deeper portions. Experiments have shown that solutions containing bacilli, used in a spray, have been inhaled, and produced consumption in animals. The intestinal canal may be infected from swallowing the virus; milk and the meat of diseased cows may infect human bodies, although ordinarily they are digested on passing through the intestines.

Tappeiner experimented upon dogs, eleven in number, chosen on account of their slight tendency to be affected by tuberculosis; they were made to inhale sputa dissolved in water by atomization. Every one of the dogs was rendered tuberculous, as proved by autopsies, tubercles being found in lungs, kidneys, liver, and spleen.

Other dogs were given food mixed with expectorated products, but only a few had miliary tuberculosis of the intestinal tube, marking the difference between the contamination by inhalation and by ingestion.

These microbes may lodge in fissures and excoriations of the skin, and produce lupus; or they may be carried by the absorbents to the nearest glands of the neck, or to the axilla, establish themselves, and produce tubercular disease. Indeed, it seems wonderful that so many of us escape infection. In numerous instances the growth is slow, and years may pass, although they are in the body, before they assert their power.

The infection frequently attacks the most important organs, and we find infectious tumors, and, subsequently, general infection. The tubercle is a well-defined nodule, which, being non-vascular, tends, by the aid of the physical conditions of heat and moisture, to be necrotic at the centre.

Many of the evil influences, such as soil moisture, mal-hygienic surroundings, bad air, insufficient food, sedentary occupations, severe illnesses, which formerly were supposed to be capable of themselves of producing consumption, we now know are clinically important factors of causation by impairing the nutrition, and rendering the animal soil more susceptible to contagion. Old alveolar catarrhs, croupous pneumonias, measles, and whooping-cough, cannot produce tuberculosis, but they often precede it. The same may be said of weak lungs and non-tubercular diseases. The bifurcations of the minute bronchi, and slight abrasions afford lodging places for the bacilli. Although the outset of pulmonary tuberculosis is often slow and gradual, yet it sometimes marches with fearful rapidity, as the currents of breathed air carry it through the lungs, causing peribronchitis, new growths, and ulcerations; the alveolar tissue becomes cheesy and necrotic with advancing consolidations, and decay with progressive wasting, ending in cavities (Powell). All of this destructive work originates from the pathogenic effects of this little microscopic rod.

When we remember how the sputum of the thousands of consumptives is scattered broadcast in the streets, much of which is readily dried—and when dried can retain its virulence for months, and be wafted by the currents of air we all breathe—we can easily understand how numbers of human beings can be contaminated by it, and are finally added to our mortality column.

Fortunately for us, even when inhaled into our lungs, these microbes do not find a resting-place if the soil is not in a condition for them to thrive in it, or the sound epithelium gives no abrasions by which they can enter.

But there is no contagious disease which spreads destruction as does tuberculosis—a large percentage of the whole mortality; persons contract it when and where they least expect it. When attacked, they think, with Graves, that it has followed some scrofulous degeneration; or, with Hughes Bennett, that it came from non-assimilation of fat; or, with Jaccoud, from general malnutrition; when, in fact, it was from inhalation of bacilli, from dried sputa, or from the milk or meat of tuberculous animals.

The detection of tubercle bacilli in the vesicula seminales, in the

Fallopian tubes, and in the uterus itself, has opened the question whether or not sexual intercourse can spread the contagion. We certainly have genito-urinary tuberculosis.

Henle's doctrine of contagium vivum awakened scientists to the idea that infectious diseases were probably the results of the introduction of living organisms of vegetable origin into the diseased body. This view has passed from the region of conjecture to that of actual knowledge. Improved microscopical appliances, new methods of staining, and pure cultivations of bacteria, have, in the hands of many observers, cleared the subject of much that was doubtful and controversial.

The pertinent question may be, and often is asked, Are there not some cases of pulmonary phthisis which are not bacillary in their origin? It must be borne in mind that the name phthisis is a very old one, derived from the fact that there was great and progressive wasting of the body observed in connection with symptoms which pointed to the thorax, and especially to the lungs, as the seat of the disease. It was not until early in this century that the term had any definite anatomical signification. In the last few years careful investigation with microscopical researches discovered this bacillus as the cause of certainly over ninety-five per cent. of the cases ordinarily designated as phthisis pulmonalis. It is not pretended that there are no cases of chronic, destructive disease from other causes.

Mechanical injuries may start inflammatory and degenerative changes in the lungs. Under this head ought to be placed what is known as *miner's phthisis*, where are found dense, fibroid indurations, with large amount of pigmentations of the lung, with infiltration of carbon, the bronchioles being sometimes choked with carbonaceous matter. It is claimed that this disease is not bacillary, but, as Douglas Powell has said, the conditions are not favorable to the development of bacilli; and, moreover, observations on this point have not been sufficient to test the question.

The disease which has been designated as *bronchiectatic phthisis*, is a chronic disease, with hectic, night-sweats, varying temperature, emaciation, and profuse and offensive muco-purulent expectoration, symptoms closely resembling catarrhal phthisis. It results from fetid bronchitis, empyæmas, or broncho-pneumonia, with pronounced dilatation of the bronchi; this is said not to be bacillary. There are cases of chronic bronchitis which, in their symptoms, resemble pulmonary phthisis. Dr. Dickinson regards *the pulmonary lesions in diabetes* as of non-tubercular, inflammatory nature; but Dreschfeld, who has atten-

tively studied it, characterizes the osseous broncho-pneumonia lesions as tubercular, and he has found at the post-mortems the tubercle bacillus.

We rarely see syphilitic ulcerations and gummatous nodules, causing diffused pulmonary fibroids, yet there is such a disease, and it has been termed *syphilitic phthisis*, but it is not pathologically a variety of consumption.

These illustrative cases ought more legitimately to be designated as *pseudo-phthisis.*

The very soul of true science, says Dr. Lionel Beale, is the continual testing of conclusions already arrived at. Such must and will be the case in regard to these results of modern research. In science it is a very easy matter to remain quiet and fixed in the views we have learned in the past. It chimes in so pleasantly with our natural proneness to indolence. We can thus avoid the fatigue of keeping ourselves alive, and we can gradually subside into a state of indifference to what is passing in the scientific world around us. Such ought not to be the prevailing course in this nineteenth century, when all should be so thoroughly imbued with the love of truth, that they will gladly accept it, no matter how it upturns their previous convictions. To do so, is no disrespect to the past, for we can only guide our footsteps by the light of the hour, when we walk. The morrow's bright sun may clear our path, and show us where we stumbled.

Let us for a few minutes inquire into the nature of this *heredity:*

I. There is general agreement that heredity is an important factor in the etiology of pulmonary phthisis, but some writers, notably Cohnheim, think that the influence of heredity has been much exaggerated.

The following circumstances are adduced to show that the influence of heredity has been exaggerated.

a. Many of the abnormalities which have been considered as characteristic of an inherited predisposition to phthisis, such as the so-called "paralytic thorax," and scrofulous lymphatic glands, are evidence of already existing tuberculosis.

b. The children of phthisical parents are likely to be surrounded with the same unhygienic influences, and to follow the same occupations which may have favored the development of tuberculosis in their parents.

c. Coming into intimate contact with tuberculous parents, or brothers and sisters, such children are subject more than others to the tuberculous virus.

d. When one considers that one-seventh of the human race die of

tuberculosis, it must necessarily happen that a considerable number of tuberculous individuals are the offspring of tuberculous parents, without it being necessary to assume that such individuals inherit any especial predisposition to the disease.

II. Even making allowance for the foregoing considerations, which, perhaps, show that the influence of heredity has been by many writers exaggerated, it still remains true that heredity is a factor of considerable importance, and requires explanation.

The explanations which have been offered are chiefly these three:

a. The disease tuberculosis is itself inherited. This is the parasitic theory of heredity, and is divisible into two sub-heads: 1. The infection takes place at the time of conception (tubercle bacilli in the semen). 2. The infection is intrauterine, through the blood of the mother.

b. The disease tuberculosis is not itself inherited, but a predisposition to this disease is inherited. This predisposition is now interpreted as the existence of some peculiarity in the structure or the composition of the tissues, rendering them suitable for the lodgement and growth of the tubercle bacilli.

c. According to some, it is not necessary to assume the inheritance, either of the disease or of the predisposition, but the apparent instances of heredity are explained by the subjection of the children of tuberculous parents to the same surroundings and occupations as their parents, and especially to the constant influence of the tuberculous virus.

According to this third view, what is generally called heredity is only a pseudo-heredity.

III. In elucidation and criticism of these views the following is to be said:

A. Parasitic theory of heredity. The following facts or assumptions are urged in favor of this theory:

a. Jani discovered tubercle bacilli in the otherwise apparently healthy testicles of eight phthisical patients five times; and in the prostate gland four times out of six cases. This observation may be urged in favor of the conceptional theory of parasitic heredity. But no proof exists that semen containing tubercle bacilli is capable of fructifying the ovum, or that the latter, if so fructified, becomes tuberculous.

b. There are a few undoubted instances of congenital tuberculosis. The most satisfactorily observed case of this nature is that of an eight months tuberculous fœtal calf, whose mother was tuberculous. Tubercle bacilli were found in the characteristic lesions of the mother and of the calf. The case was observed and reported by Johne. Several

other instances of congenital tuberculosis have been reported, in cattle. We have the high authority of Prof. Welch for the statement that not *a single, undoubted and thoroughly convincing case of congenital tuberculosis in the human subject has been reported.* Cases have been reported in which advanced tubercular lesions were found in infants dying within the first one or two months of life, where it seemed reasonable to suppose that the disease was congenital, but this supposition could not be positively proven, as infection might have taken place after birth. Even admitting the occasional occurrence of congenital tuberculosis in the human subject (and such has not been actually proven, although it is probable), the fact remains that such cases are so very rare that they are rather opposed to, than in favor of, the parasitic theory of heredity as a frequent factor in the causation of tuberculosis.

c. It has been urged that there are many points of analogy between syphilis and tuberculosis, and that, as we know syphilis is often inherited, so we might conclude that tuberculosis can be inherited. In reply, it is to be said that parasitic disease differs as regards the readiness or the possibility of the transmission of the parasite from the blood of the mother to that of the fœtus. This possibility depends upon whether the parasite can pass through the membrane separating the maternal from the fœtal circulation. In anthrax or malignant pustule this transmission of the parasite cannot take place; although the blood of the mother is swarming with anthrax bacilli, none can be found in the fœtus. Tuberculosis, in this respect, seems to belong to the class of diseases like anthrax, rather than to such as syphilis. This idea is supported by an observation of Jani, who made a careful examination of the five months' fœtus of a woman who died of acute miliary tuberculosis, in which it was proven that tubercle bacilli were in the circulating blood; neither in the placenta, nor in the fœtal organs, could be found the tubercle bacilli, or any evidences of tuberculosis. Still less is it likely that the bacilli could gain access to the fœtus in cases of ordinary pulmonary phthisis, where tubercle bacilli rarely, and then only in a very small number, enter the circulating blood. Then the analogy between syphilis and tuberculosis is defective in this respect, as pointed out by Lichtheim, viz.: inherited syphilis differs in important particulars from acquired syphilis, one point especially being that in the former the manifestations occur at once, as if the poison were in the circulation, whereas in the latter the poison remains for a time circumscribed, local at the seat of its reception. No forms of tuberculosis exist with any distinctions like those between inherited and acquired syphilis. The so-called inherited tuberculosis

does not differ from the acquired. The virus has evidently entered in both cases at the same portal.

d. It is, of course, necessary to assume, on the parasitic theory of heredity, that the tubercle bacillus received, either at the time of conception or during intrauterine life, remains in most cases dormant through infancy and childhood, and not until the time of puberty or later undergoes development. This doctrine of latent tuberculosis has been advocated especially by Baumgarten, in No. 218 of *Volkmann's Samml. klin. Vortrage.* Baumgarten has failed to bring forward any substantial proofs of this assumption. He mentions the occasional development of tuberculous disease about joints or bones which have been previously resected for tuberculous affections. He assumes that where the recurrence of the disease is preceded by months or years of apparent recovery, a small tuberculous focus, which escaped removal at the operation, has remained latent during this period. Such cases are very rare, and there is at least as much reason to assume a second infection as a period of prolonged latency. An important argument against the assumption of congenital infection with the tuberculous virus followed by years of latency, is the very exceptional occurrence of congenital tuberculous disease, as has already been mentioned, an occurrence so exceptional that its very existence in the human subject is denied by Virchow, and, to say the least, is doubtful.

As bearing upon this point, as well as upon the general subject of parasitic heredity of tuberculosis, the following words of Koch may be quoted: "There are no facts which justify the assumption that tubercle bacilli can be present, either in intrauterine life or in extrauterine life, in the organism of the child, without their producing manifest changes within a comparatively short time. Now, tuberculosis has hitherto been found only very rarely in the fœtus or in the newborn, and from this fact the conclusion can be drawn that the tuberculous virus causes infection only very exceptionally during intrauterine life. It is in harmony with this view that, of the animals upon which I experimented, particularly guinea-pigs, which become not infrequently pregnant either before or after the tuberculous infection, not one gave birth to young which were tuberculous at the time of birth. Young cast by mothers in advanced tuberculosis were free from tuberculosis, and remained healthy for months. In my opinion, hereditary tuberculosis is most simply explained by assuming that not the material of infection itself, but certain qualities are inherited, which favor the development of the germs with which the body at a later period comes into contact —that is, that which we call predisposition, is inherited."

B. Predisposition theory of heredity. This is the doctrine advocated by the great majority of writers. As has been seen, there is very little evidence in support of the parasitic theory of heredity, although there is inherent impossibility in the latter theory. If the parasitic theory of heredity be rejected, and if we admit, as we must, the influence of heredity in the causation of phthisis, nothing remains but the doctrine that heredity is manifested by the inheritance of characteristics of tissue or fluids favorable for the development of the tubercle bacilli. Not much success has attended the efforts to define in what abnormalities of structure these characteristics reside. The attempts to identify this predisposition with the existence of a certain formation of thorax (so-called paralytic thorax), with premature ossification of the joints of the first rib, with abnormally wide bronchial terminations, with small size of the aorta in comparison with the pulmonary artery, with small lymph-spaces, etc., cannot be regarded as successful. We are not able at present to define the nature of this predisposition in terms more precise than those adopted by Koch in the foregoing quotation. Inasmuch as for cholera and certain other infectious diseases we have obtained tolerably clear ideas as to the nature of so-called predisposition to the disease, we need not despair of being able to define more precisely, at some future time, the physical or chemical substratum of predisposition to tuberculosis. At the present time we have to reckon with predisposition, indefinite as the term may sound, as a factor in the causation of tuberculosis of equal importance, from a clinical point of view, with the tubercle bacillus itself. It is only by keeping constantly in view this factor of predisposition that we can reconcile the clinical with the pathological and etiological facts concerning tuberculosis.

C. Doctrine of pseudo-heredity of tuberculosis. There are some who consider that most, if not all, cases of apparently inherited tuberculosis may be explained without assuming inheritance, either of the disease or of predisposition thereto. They emphasize especially the circumstances which have already been mentioned, such as the intimate association of the children of tuberculous parents with those already subject to the disease, the continuance by the children in dwellings or other surroundings favorable to the development of tuberculosis, the continuance of occupations which have given rise in the parents to a condition predisposing to tuberculosis, etc. It is also to be remembered that an inheritance of tuberculosis may be simulated by the early infection of children, as by the milk of tuberculous cows. These are, doubtless, all circumstances which should be taken into

consideration in estimating the importance of heredity, but it cannot be that physicians, from the time of Hippocrates to the present, have been mistaken in believing that heredity is an important element in the causation of tuberculosis. Statistics show that the lowest estimate affords 10 per cent. of cases in which tuberculous persons were descended from tuberculous ancestors, and the highest estimate gives 83 per cent. of such cases; the average of a series of statistics yielding about 30 per cent. It is unjustifiable, therefore, to throw overboard altogether the doctrine of heredity in the etiology of tuberculosis.

In a recent series of articles by Wahl, entitled "Concerning the present state of the question of heredity in tuberculosis," he reaches the following conclusions:

"1. A parasitic heredity, whether conceptional or by intrauterine infection, although not impossible, has, up to the present time, not been proven.

"2. The inheritance of tuberculosis is explained by the inheritance of certain anatomical and physiological abnormalities, which favor the formation of an individual predisposition, of a nutritive basis for the bacilli.

"3. The precise nature of the predisposition has not been explained. It is based probably upon certain modifications of nutrition which render possible a toxic action of certain chemical products produced by the growth of the bacilli.

"4. A large number of cases of tuberculosis, which have been hitherto ranked as hereditary, do not belong to the category of heredity, but are the result of infection under circumstances which simulate inheritance of the disease."

In conclusion, the words of Ruhle in the Second Congress of German Physicians at Wiesbaden, may be quoted:

"If the inheritance of human consumption be true—and we believe it; if the bacilli represent the infectious material of tuberculosis—and we entertain no doubt of this; then both facts must harmonize with each other, no matter how obscure the manner of harmonizing may be to us. Whether there is one or there are several ways in which inheritance may maintain itself; whether it is the tubercle parasite itself which is transmitted or a certain constitution of the nutritive substratum, upon which the universally present germ may take lodgement, this we do not as yet know, but it will be learned when investigations have been made in this direction, and from this point of view."

Conclusions.—We feel justified in stating that the experimental as

well as the clinical study of tubercular phthisis has established the fact that there are three factors in its causation:

First. The presence of the parasite, the tubercle bacillus, as a pathogenic element. This is a factor necessary for the production of the disease.

Secondly. There is a prominent element in about thirty per cent. of the cases ordinarily met with, a susceptibility transmitted by heredity.

Thirdly. The mal-hygienic and debilitating agents, such as foul air, sedentary occupations, violations of the laws of health, other diseases, and prominently soil-mixture, have a powerful effect, by impairing nutrition, in developing the disease.

Heredity and lowered vitality cannot, of themselves, produce tuberculosis; but, clinically, they play an important *rôle* as factors, by rendering the individual more vulnerable to bacillary influence.

Treatment.—How can we prevent or control the virulence of the microbe, and how can we lessen the individual susceptibility, hereditary or acquired?

We know some of the laws of the propagation of the parasite, and we must endeavor to change the fertility of the animal soil. It is this heredity which pathologists consider responsible for, at least, one-third of the mortality. In many children of consumptive parents there are well-known evidences of some fault of nutrition which give them a delicate appearance, but there are families who pay their tribute to a sad heredity in the midst of healthy appearances. We have, in our prophylactic treatment, two courses to pursue: first, to improve the general health and strength of the subject; and the next is to protect them, as far as possible, from contagion. It is obvious that persons suffering with phthisis, or with a marked predisposition to it, should not marry, and still more, that they should not intermarry. A girl should not marry until she has completed her physical development. As clear as are these prohibition rules, yet an absolute monarch could not enforce them. The child of consumptive parents should be watched and cared for from its birth. A mother with phthisis should be rigorously prevented from nursing her baby, and, if possible, a healthy wet-nurse should be provided for it, until nature shows, by the development of teeth, that it is prepared for other food, together with milk. The hygiene of the nursery should be looked after, abundance of air space with free ventilation, and a comparatively low temperature, careful attention to bathing, and the wearing of loosely fitting, light, woollen under-garments. As far as it is possible, the hereditarily predisposed to phthisis should lead an outdoor life, especially between the

ages of fifteen and twenty-one years, taking care always that every part of the person should be protected by good, light in weight, non-conducting clothes. The beneficial influence of sunlight, the source of all life and force, indoors and out-of-doors, should never be lost sight of. All sources of glandular irritation, eczemas, eruptions of the scalp, and catarrhal affections should be avoided; scrofulous glands should be promptly dispersed, and, if necessary, removed. Human beings, as well as the lower animals, when deprived of light, exercise, and nutritious food, readily fall victims to tuberculosis. City occupations and residences are not desirable, but well-ventilated country homes on high grounds, with southern exposure, and dry, well, thoroughly drained surroundings, should be sought for. The physical frame of the chest should be enlarged by mechanical movements and gymnastics under cover, but not in shut-up rooms. Sedentary occupations, especially in crowded quarters, are dangerous. Impure air, in and out-of-doors, must be scrupulously avoided. If it be possible, the predisposed should select their homes in climates of high altitudes, which are peculiarly adapted to ward off any development of the disease. They would there have the healthful mechanical effect of lessened barometric pressure; of the dryness of the atmosphere, of the low temperature, and, above all, of the great purity of the air they breathe, resulting from its freedom from organic and inorganic dust, and its aseptic qualities, owing to the absence of putrefactive and fermentive germs; its large proportion of ozone, and of the diaphaneity of the atmosphere—all influences which clinical observation has proved to be especially beneficial in improving the nutritive functions, and promoting the general health. Of medicines, those only should be used that assist in digestion, or, such as arsenic or iron, which improve the blood-making functions. Oleaginous food, such as milk and cream, are valuable when readily digested and assimilated. Dr. Hughes Bennett used to say that two of the main causes of tuberculosis were the dearness of butter, and the abundance of pastry-cooks. Of all fats, the most readily digested is cod-liver oil, and it is the most beneficial, owing, according to Dr. Brunton, to its greater mobility. Thus, we try to fortify the threatened subject, and, by hygienic treatment, we ward off the disease. We must all concur with Dr. Fagge, that there probably is no family in which the consumptive tendency is so strong that it could not be kept in abeyance by hygienic precautions, if they were thoroughly and vigorously carried out. Here is preëminently a case where prevention is infinitely easier than the cure after the disease has commenced.

Our next duty is the recognition of the insidiously contagious character of the disease. If we only could devise some means by which we could all be protected from this destructive microörganism, what a blessing it would be to the human race! How it would diminish the mortality throughout the world! If it were only possible, after it has taken possession of the lungs, to destroy it by agents which could not injure the lungs themselves! The advocates of gaseous enemata frankly tell us that, while they claim to lessen materially some of the injurious effects of the tubercle bacilli, yet they do not destroy them. It has been truthfully said, that every patient with developed phthisis may be regarded as a laboratory in which pure cultivations of the pathogenic microörganism are steadfastly and successfully made and expectorated daily, it may be, for years. When moist in the sputum it is easy to destroy them, for they are mixed with mucosities, antiseptic solutions of sulphate of iron, bichloride of mercury, and such agents. When left to dry, they float in the atmosphere, and can be carried in clothing as easily as the epidermic scales of scarlet fever. Spittoons and other receptacles in sick rooms should not only be removed, but their contents should be promptly disinfected. If pneumatic cabinets are used for their undoubtedly good mechanical effects in cases of phthisis, the same cabinets should not be used for such purposes by those from whom we desire to ward off the disease. When used they should be placed out-of-doors, or in rooms not occupied by consumptive patients, otherwise harm, instead of good, may result. Cities are known as permanent centres of transmission of the microphyte. Our dust and dried dirt are scattered far and wide by winds, and often they contain dried tubercular expectorations. Soiled carpets and linens often contain expectorated poisons.

Since the pearly distemper in cattle is found to be identical with tuberculosis in man the use of the flesh of such animals, as food, furnishes a possible means of infection. When pearly nodules have been shown to be present in the udder, the milk of the diseased animal may be polluted by tubercle bacilli. The use of such milk and meat as food, even when cooked, certainly involves the danger of the transmission of tuberculosis.

It is now known that the susceptibility of cattle is similar to that of human beings. In some warmer climates the mortality in cows from tuberculosis amounts to two per cent.

When, in addition to hereditary tendency, persons are subjected to privations, indulge in excesses, lead sedentary lives, have unhealthy environments, or are depressed by grief or anxiety, very few will

escape the deadly effects of the tubercle bacilli. If the prophylactic treatment is carried out thoroughly well, the hereditary and the acquired proclivity to phthisis may remain latent, and the individual never contract the disease.

DISCUSSION.

Dr. J. C. Wilson, of Philadelphia, said: The President has done good work in bringing this subject before the Association in this clear and positive manner. The more carefully we examine the clinical and laboratory work, now rapidly accumulating, which relates to the hypothesis that pulmonary consumption, in nearly all its forms, is an infectious, parasitic disease, the more satisfactory that hypothesis becomes, and the less difficult the apparent obstacles to its acceptance. In truth, the simpler we make the etiological generalization, the better it meets the requirements of the morbid anatomy and clinical history of the disease.

I have risen rather to endorse the views expressed in the paper than with any other object. If there are those present who entertain views opposed to these, let them present them, in order that we may have an active discussion on the subject. So far as statistics indicate the real mortality from this disease in the civilized world, I am disposed to think that it is much higher than is generally supposed. Many cases, in which death occurs from other causes, are already the subjects of phthisis, but the deaths are returned as due to the intercurrent disease.

There are two or three points to which I should like to refer. In the first place, the newborn child of tuberculous parents, and particularly the newborn child of a tuberculous mother, is not only liable to the general and especial dangers of infection to which the parents have been exposed, but in view of the closest of personal relationships it is subjective to peculiar exposure, so that the development of tuberculosis in early infancy is, in such cases, rather to be expected than otherwise.

With reference to the questions of heredity and infection, it seems to us that, looking at the matter in the simplest light, infection occurs as the result of some want of a thorough ventilation of the lungs in all parts, and a loss of integrity in the pulmonary tissues. Heredity must lie in a predisposition. Then infection is induced by the long continuance of such conditions of life as diminish respiratory force, and cut down to a dangerous point the ventilation of the lungs.

Dr. B. F. Westbrook, of Brooklyn, said: As the discussion has been entered upon, I think it would be meet to call particular attention to some of the details with reference to predisposition to phthisis. That the development of phthisis depends upon a predisposition in the early stages is

undoubtedly true. I think that a distinction should be drawn between diffused miliary tuberculosis and chronic phthisis, which we see every day. In acute diffused miliary tuberculosis there is probably always some focus from which the diffusion of the tubercular virus takes place. In the chronic cases, this is not necessarily the case. The susceptibility of the lungs to the development of phthisis is probably dependent on anatomical and physiological conditions. The predisposing causes to these troubles are, according to the results obtained by good observers, particularly Benecke, and Thoma, of Germany, and Brehmer, of Goerbersdorf, a disproportion between the size of the lung and the heart, the heart being smaller in proportion to the size of the lungs than in the ordinary well-developed individual, and, in the second place, a disproportionately small digestive tract. This has been particularly worked out by Benecke. It is interesting to consider why a person, whose heart is out of proportion to the size of his lungs, should be liable to the development of phthisis. It is probable that 99 per cent. of cases of chronic phthisis have their commencement at the apices of the lungs. These parts of the lungs are not so well situated for the proper carrying on of the circulation as are other portions. This part of the chest is comparatively immobile. The apices rise above the clavicles, and are simply covered by the pleura, the deep cervical fascia attached to the scaleni muscles, and the skin. During ordinary respiration these parts are very little affected, so that the circulation, under quiescent conditions, is not very active. It is not so much the circulation of air in the apices as the circulation of blood that is affected. We know, from the experiments of physiologists, that the circulation of blood in the lungs is largely dependent upon the circulation of air. The movements of the lungs attract the blood into them, and propel it on into the left side of the heart. Those persons who are apparently predisposed to phthisis, usually have poor expansibility. Although the lungs may be large, the vital capacity is small. Owing to want of expansion, the blood does not circulate, there is lack of nutrition, and, as Hamilton points out in his work on the *Pathology of Bronchitis*, etc., there is a tendency to dryness, and an accumulation of the products which may be present in the apices. Absorption does not readily occur, and expectoration is not easy. The consequence is that, if there is any disturbance, or the person catches cold, the inflammation tends to start its most malign influence upon these portions of the lung, and the deficient vitality of the individuals I have described contributes toward the existence of a nidus in the tissues for the development of the germ which tends to the appearance of tuberculosis. The outcome of all this is, of course, what has been stated by the President. The hygienic conditions are the same that have been given. I thought it well to call attention to some of these anatomical and physiological details, particularly the disproportion between the size of the respiratory and circulatory organs, and the diminished capacity for nutrition resulting from the small digestive tract, in order that we might have a more definite theory whereon to base our therapeutical measures.

THE PHILOSOPHY OF CLIMATIC TREATMENT OF CHEST DISEASES.

By JAMES R. LEAMING, M.D.,
OF NEW YORK.

The aphorism of Cullen, that the air of any place is better for the patient than that in which he grew ill, is born of experience. It suggests *change* in pursuit of places of greater salubrity than at present enjoyed, and thus stimulates the imagination of the poor invalid to dream of some elysium, somewhere upon earth, where lost health and strength might surely be restored, and the delightful sense of recuperation enjoyed.

The earliest health resorts were probably to springs and fountains to which miraculous cures were ascribed; especially if they emitted gas or spouted out of the rocks, or were hot, or smelled of sulphur, then they were believed to be the abode of spirits, which gave them healing efficacy. Every nation had its sacred waters, like the Ganges, the Jordan, or the Pool of Siloam. The Greeks and Romans built temples to Hygeia upon hills near such inspired springs and fountains.

During the middle ages Oriental merchants carried, not alone talismans of precious stones, but also sealed bottles of sacred water and precious healing wines. Even at the present day water is brought in this way from the Jordan for the sacred purpose of baptism.

In this way localities became famous for cures, and pilgrimages were made to distant parts of the then known world, and change of scene and air with applied faith assisted in restoring the feeble to health.

But it was not until 1820, when the history of the now classic tours of Sir James Clark to the different popular health resorts of Europe was published, that the profession began to collect statistics of the temperature and moisture, and their comparative sanitary effects, for the scientific guidance of the sick.

Since then, sheltered spots among the Alps, at Ems, Pau, Nice, Mentone, in Greece, Egypt, and Algiers, and other places, have

retained their early reputation, and are, to-day, among the most frequented.

The history of the western hemisphere, in regard to health resorts, is but a repetition of that of the eastern. Springs and fountains, thermal, sulphurous, saline, and gaseous, were known to the Indians before the advent of Europeans as charmed waters. They were equally believed in by the early settlers as cures for special diseases, but, as in the eastern, it was soon found that mostly where the resort was in virgin forests of pines, or over deep sandy soil, in sheltered places upon hills or mountains, weak and diseased lungs received strength and recuperation.

Canada, New England, the Middle States, the Carolinas, Georgia, and Florida, furnish these requisitions fully near the Atlantic coast; while California, Texas, New Mexico, Colorado, Minnesota, and Manitoba, afford even a wider range upon the western. Each has its peculiar advantages, and all afford, with the mountains in the interior, selections for the happiest changes.

The predilections of patients and physicians are generally for a change to warmer climates, and, other things being equal, it may be best to go where outdoor exercise can be enjoyed, and the cold and damp of northern winters be avoided. But there are many exceptions to this rule; dry, cold, equable air is many times curative. It seems paradoxical, simply because our preconceived ideas are not of experience.

But all these facts merely emphasize the law of change, which is the law of nature. We see it in the varying seasons, day and night, and in the recurrence of heat and cold. It has been observed, too, that the greatest improvement in health takes place during the first two or three weeks of sojourn in a new place. Bearing these clinical facts in mind, and by methodizing and combining a system of changes from inland to the sea, from the sea inland, from north to south, from south to north, from the valleys to the mountains, from the mountains to the valleys, keeping pace with the march of the seasons, like birds of passage, it has been proposed to establish health resorts at convenient distances, with graduated changes, commencing at the North in the early summer, and going South, stopping at each resort for a few weeks only, and leaving as soon as the freshness of the new place has worn off, for the next in the course, thus getting into a warm climate in the winter, and returning back home in the spring. The same would be done upon the Pacific coast, or on the central rocky ridge of mountains and table-lands, always taking advantage of especial conditions of soil, forests, fountains, and springs.

To those subject to winter coughs, a sail in the autumn to Bermuda, thence to the different groups of West India islands, returning along the coast of South America, lingering at Trinidad and Caracas, and reaching home after the winds and storms of winter have passed, may be singularly effectual.

The natural health resorts upon the Western Continent are unsurpassed in excellence and variety, yet, for a very large number, the old world always will afford attractions which increase tenfold the natural advantages. Tradition, history, poetry, and fable combine to fill the mind with joyful anticipations in visiting scenes of the world's past history, producing a state of mind conducive to recuperation.

All of these schemes are available for those who have incomes sufficient to adopt the system of changes which is more curative than to spend the whole time in any one locality, no matter how salubrious; and will avoid crowding, than which nothing is more injurious to those with diseases of the lungs.

But to a large number in every city or community, such delightful methods are beyond their means.

The laborers, mechanics, and skilled artisans of a country form the great body of its producers. Their welfare becomes a question of State policy. Their labor is the chief element in the wealth of a nation, yet, individually, they are frequently improvident, and they are particularly liable to chest diseases. They have a full knowledge of their importance as members of the body politic, and of the inequality of their position, and the evil tendencies of this knowledge has been mischievously stimulated to law-breaking and self-injury by the bad teaching of self-imposed leaders. Could these people be made to feel that the State regards their true interest with intelligence and kindly solicitude, it would go a great way to quiet turbulent risings of dissatisfaction among them. It is true that this rebellious element is altogether un-American, and is the result of ignorance of the principles of a representative form of government—that all the people form the State. Yet, notwithstanding, it exists in cities and in communities of miners and manufacturers, and must remain so until greater homogeneity shall have been acquired by admixture with the native element. In no other way can these people be more speedily brought under these educating influences than by the establishment of well-regulated sanitariums, which they must learn to know are under the government of the people of which they are a part; then they will appreciate their interest in these means for the most successful treatment of the deadly

diseases which they and their families, by heredity and acquirement, are so liable.

The existing establishment of parks and dispensaries in cities has, in part, supplied this want. The parks are breathing places as well as pleasure grounds, and furnish limited climatic treatment of chest diseases. A ride through the parks will demonstrate the fact that they are practically used by the poor as well as the rich in this way.

A sanitary park at some convenient distance from a population centre, chosen on account of its soil, springs, and running water, covered with evergreen trees, could be set apart for a health resort, in which an educational sanitarium could be built, with gymnasiums and baths, and rooms with medicated atmospheres, and applied methods, such as the pneumatic differentiator, for expanding the chest, interpulmonic, and gaseous rectal injections, and for other methods of overcoming pulmonary disabilities. Both the park and the sanitarium should be under medical police of the most intelligent professional skill, and should be placed within the means and the reach of all.

The subject is of immense importance, and is entirely feasible.

Lord Bacon, the greatest genius of all time, as well as the most practical of philosophers, in that wonderful fragment, the *New Atlantis*, imagines a State in the New World, perhaps a vision of the future of the United States, in which the laws and customs are brought to great perfection, conducing to a wonderful state of happiness, and the physical and mental welfare of its people. In the city of "Bensalem" was an institution for the advancement of all knowledge pertaining to the sciences and the physical welfare of mankind, called "Solomon's House" (a kind of Johns Hopkins University), and including a sanitarium.

One of the wise men of "Bensalem," in describing it, says: "We have, also, certain chambers, which we call 'Chambers of Health,' where we qualify the air, as we think good and proper for the cure of divers diseases and preservation of health."

This quotation contains, so far as I know, the earliest suggestion from authority for a sanitarium where scientific methods for the treatment and care of respiratory diseases could be thoroughly carried out. Scattered over our vast country are many localities fitted by nature for sanitary parks. The New Jersey coast from New York harbor to Cape May may be selected for illustration. There are many other localities of equal, perhaps of greater advantages. But this has deep sandy soil, and there are still thick forests of pine woods covering portions of it. These are growing less every year, and, unless there shall be a combined effort to preserve them, will soon have passed away.

This region is already known as a good health resort. If, in addition to the present forests, groves of evergreens could be planted, and sanitary parks set apart, each with a central sanitarium, or "Solomon's House," not expensively built, but roomy and convenient, with cottages or tents scattered throughout the whole extent, for the temporary occupancy of families having members suffering with pulmonary diseases, what a grand "Sanitaria" we would have.

The scientific management and treatment could be carried out on a grand scale, and definite results could be obtained. The crucial test could be applied to theories, and vaunted methods of treatment could be tried, and their true value ascertained.

This would necessarily lead us to study the true philosophy of treatment, and to learn *what it is* which benefits, and to apply this principle in all cases with unvarying success. Horseback riding from the earlier times has been, and still is, generally regarded as beneficial for weak lungs. What is it which benefits in this exercise? The patient who is much in the saddle will learn by experience to choose the gait of the horse most beneficial and most comfortable. The fast walk for invalids, in most cases, will be selected, so that, with the exhilarating effect upon the mind of this method of locomotion, there is the equalized exercise, always gentle, of every part of the body.

But, more than all, as the horse steps long, in walking fast, the rider holds his breath, or breathes slow in order to balance himself, and thus is gained, without fatigue, the indispensable condition for improvement, gentle continual expansion of the lungs, and, of course, of the chest.

Those who are benefited by going to sea, and many are, must be constantly on deck. On deck they hold in the breath, or breathe slowly, in order to balance themselves, and in this way efficiently expand the chest and the lungs. They had better have remained on shore than to keep in their state-rooms. What do we instinctively do on entering the pine woods but take in full inspirations, and exclaim, How delightful! We instantly breathe more slowly and more fully, and natural expansion of the chest results. This is the chief benefit in every method of treatment—gentle, continued, natural expansion of the lungs and of the chest. It must be gentle, natural, continual. Natural, healthful, unhurried respirations are about sixteen times in a minute

A person with a weak chest, long before he, or his friend, considers himself a patient, will increase the frequency of his respirations. He breathes frequently to make up for the lack of natural full inspirations.

To get strong he must go back to the normal frequency and fulness of respirations. It is better not to do it with violence or until fatigued, and it will only become entirely successful when it has become the natural habit.

And this is the true philosophy of climatic, or any other successful treatment of diseases of the lungs. The blood is sent to the lungs for aëration. Unless the lungs are expanded so that every capillary in the true respiratory system is unobstructed, this will not be accomplished.

Local stasis in the true respiratory system is the visible, tangible beginning of pathological results within the lungs, whether tubercular, fibroid, or catarrhal.

Not the only, but the essential benefit of climatic treatment is reforming and keeping the habit of natural breathing.

The poor cannot leave their homes or intermit their daily labor. To them, accessible sanitary parks with sanitariums and dispensaries are a necessity. There they can be taught to reform the habit of too frequent breathing. I know practically that this can be done, even in a great city, in which the air is loaded with disease germs.

In a professional life now extended beyond the average in time, there is nothing of which I have become more certain than that, even under the worst circumstances of air and locality, consumption may always be prevented by proper food, chest expansion, and exercise, and, with few exceptions, the same means will arrest it in the commencement, and remove the results. Consumption is a preventable disease. The methods should be taught in the schools and in families, in sanitary parks, and in places of amusement.

And this brings us to consider the most prolific cause in the etiology of phthisis: depression of the organic life from emotional causes, such as fear, anxiety, worry, sorrow, or despair; increasing the number of white globules of the blood, and preventing the natural remedy of sufficient aëration by full inspiration.

A condition of hyperplasticity and stasis gives occasion for plastic exudation through the delicate coats of the capillaries upon pleural or other serous surfaces, or into cellular connective tissues, and which, organizing into pseudo-membrane of low vitality, forms pathological products with necrotic tendencies.

The emotions are subject to education, courage, especially by function. A calm contemplation of the end of life, which is common to us all, as Bacon says, and therefore cannot be so dreadful, enables us to live longer, and with greater mental efficiency. We should live, as

Bryant says, so that when our summons comes, we go, not like the "quarry-slave, scourged to his dungeon," but "like one who wraps the drapery of his couch about him, and lies down to pleasant dreams."

Byron makes poetic use of the fable of the scorpion surrounded by fire stinging itself to death; an act, not, as the great poet supposes, of heroism, but of cowardice. He, himself, dying at the early age of thirty-six from Bright's disease, was as clearly a suicide from the indulgence of ungovernable emotions, increasing the plasticity of his blood, as if he had ended his life with a bullet.

In "Measure for Measure," the Duke, entering a room in the prison disguised as a friar, says:

"So then, you hope of pardon from Lord Angelo?"

Claudio. "The miserable have no other medicine, but only hope. I have hope to live, and am prepared to die."

Duke. "Be absolute for death" (that is, meet death resolutely), "either death, or life,
Shall thereby be the sweeter. Reason thus with life:
If I lose thee, I do lose a thing
That none but fools would keep; a breath thou art,
Servile to all the skyey influences,
That do(st) this habitation, where thou keep'st,
Hourly afflict. Merely, thou art death's fool;
For him thou labor'st by thy flight to shun,
And yet run'st toward him still."

THE INFLUENCE OF SEA AIR ON SYPHILITIC PHTHISIS.

By ROLAND G. CURTIN, M.D.,
OF PHILADELPHIA.

My motive for intruding upon your valuable time is merely to arouse interest in the investigation of the climatology of that disease which is the most important coming within the domain of this or any other society for consideration. I refer to phthisis. In looking over the literature of the subject, we find a surprising latitude and diversity of opinion as regards the proper climate for consumptives. Occasionally, we find physicians giving their testimony in favor of a seaside residence for their consumptive patients, sending them to Florida and the New Jersey coast or like localities, while the large majority of practitioners are very decided in their opposition to such a recommendation. Where there is such a diversity of opinion in regard to the climatology of such a common disease, there must be something for us yet to learn on this subject.

In almost every medical man's experience, he knows of cases of phthisis that seem to be benefited by sea air. A gentleman with lung trouble finds that his condition improves only while at sea on his yacht. On shore he "runs down," and the disease progresses unfavorably. Again, another patient, apparently similarly affected, is made worse by a sea voyage, or a residence at the seaside. Why is it that such a diversity of opinion and experience prevails? Perhaps the cases I here report may be a means of solving this vexing problem. The usual experience with patients afflicted with phthisis, when sent to the seaside, is, that they improve for one, two, and in some rare cases, three weeks. They then begin to run down rapidly, so that at the end of a month they are worse off than when they first reached the sea air. Following this, the disease progresses much faster than if they had remained away from the ocean. The improvement first noticed is due probably to the change of air, food, and scene, but the diseased lungs do not long withstand the disadvantages of the condensed, moist, and stimulating salt air.

It has been my lot to observe five cases of what seemed to be syphilitic lung trouble, in which sea air was apparently advantageous as a remedial agent.

Case I.—A young physician while resident in a Philadelphia hospital, contracted a chancre; following this he had marked symptoms of constitutional infection, papular eruption, mucous patches, falling of the hair, osteocopic pain. While these symptoms were progressing he was seized with a cough, had some fever, and evidences of consolidation at the apex of his right lung. Later the consolidated lung showed signs of breaking down. The constitutional symptoms were slight, and a diagnosis of latent pneumonia was made. He was slowly breaking down in health and strength, and the lung tissue showed signs of increased trouble around the diseased part. The physical signs were tubular breathing, large and small bubbling, pectoriloquy, and at times a cracked-pot sound could be elicited by percussion. He was so persistently running down, notwithstanding specific, tonic, and other supportive treatment, that, desiring to be among his relatives, who were across the sea, he took a slow steamer to go to them. He was surprised and delighted to find himself greatly improved in health when he reached the other side. Dyspnœa, which had been a marked symptom, was greatly diminished. After remaining a while on shore, he found that his old symptoms were returning. He, therefore, took the position of surgeon on a steamer running between England and Brazil, months being required to complete a voyage. When again on sea he noticed the same improvement that he had experienced previously while crossing the ocean on the way to his family. He made voyages continually for three years. At the end of two years I examined him and found about the same amount of induration in his right lung as when he left this country. The cavities had contracted somewhat and were perfectly dry. He had gained in flesh and strength, and, although there was an occasional dry and hacking cough, he had no expectoration. Dyspnœa was not at all troublesome. One year later he returned to this country and abandoned the sea. His condition at this time was much the same as just described. As soon as he began to live on shore the old disease seemed to take up its march, and in about a twelvemonth he died of symptoms of advanced phthisis, associated with tertiary symptoms.

Case II.—A. C., a sailor, thirty-eight years old, a native of the United States. He was an inmate of the Pennsylvania Hospital. Four years before admission he had contracted a chancre, which was followed by unmistakable evidences of constitutional infection. A few months later he had some lung trouble, as shown by a cough, fever; later by dyspnœa on slight exertion, expectoration, and progressive emaciation. Being impecunious, the only avenue that presented itself for making a living, was the vocation of a sailor. He accordingly went to sea and improved in flesh and strength;

respiration was easier. This was independent of any treatment. Subsequently, he was unable to live at his home (a locality removed from the sea) without a marked increase in his pulmonary symptoms, even with appropriate treatment. He came to Philadelphia, began to drink freely, and had soon to take refuge in the hospital, where he died. Post-mortem examination revealed chronic lung trouble, without evidence of tubercle.

Case III.—Mrs. E. died at the age of twenty-nine, having been married ten years. She had never been pregnant. Her history antecedent to marriage was as follows: She menstruated first at the age of eleven years, and had dysmenorrhœa always afterward. At nineteen she was married to a seafaring man of rather loose habits, who had contracted venereal disease at least once after marriage. She had never been very rugged, and was subject to dyspepsia and diarrhœa at times, from her early girlhood. She had had a cough from early life, but it did not affect her general health, until at time of her marriage. After marriage she had several attacks of lung trouble of rather indefinite character, each attack leaving her in worse condition than before. Dyspnœa was always a marked symptom. She also had osteocopic pains. During the last year of her life she had ozæna, with destruction of the bones of the nose and loss of the septum almost down to the lower margin. During the last four years of her life, it had been her habit to go to the seashore for several months in the summer. While there, night-sweats would disappear; she would improve in flesh and strength, have less dyspnœa and less expectorations; her appetite would improve, and all her symptoms were ameliorated, and this was entirely independent of any medication.

Case IV.—C. H. in early life had chancres, followed by secondary, and then tertiary symptoms. He then had an attack of subacute pulmonary trouble, and subsequently exhibited evidences of phthisis, as indicated by physical signs: chronic cough, with purulent and frothy expectoration, occasionally a rather copious hemorrhage, night-sweats, slow emaciation, marked dyspnœa, accompanied by manifestations of tertiary syphilis. While the last-named conditions were present, he was induced to leave his mountain home, and go to an island on the New Jersey sea-coast. While at the latter place all medication was suspended. At the end of a week's sojourn there his condition was markedly improved in every respect. He was able to eat with a relish, sleep well, and go about without the fatigue which had kept him in almost a quiescent state previously. He extended his sojourn for two months, during all of which time these favorable conditions continued.

Case V.—E. C. had contracted syphilis, and soon afterward had lung trouble, which left behind a vomica at the apex of his right lung. A few years afterward he married, and, as a result of this union, he had five children. Of these children, one daughter began to spit blood at twelve

years of age; she afterward expectorated a considerable quantity of purulent matter. Following this, there was a general running down of the powers of life, associated with some expectoration, and considerable emaciation. This continued for about a year, when her health began to improve, and she remained quite well until after the birth of a child, which happened when she was twenty-four years of age. From this time she steadily failed, and died when her child was about a year old. I made a post-mortem examination upon the mother, and her father, and found at the apex of the right lung in each case conditions identical, a cavity with a smooth surface, the size of a small orange, and lined with old, granulated epithelium. A brother had a cough, with hemoptysis, while a half-grown boy, followed by much the same symptoms as mentioned in the case of his sister. He is still living, and is said to have weak lungs.

Another brother, at the age of eighteen, had a cough, and seemed to be in danger of dying of consumption. He went to sea, and recovered his health to a great extent. Afterward, trying to live on shore, he found the symptoms of phthisis returning. He again went to sea, with precisely the same beneficial results as previously experienced. He remained on shipboard almost continuously for three years, after which time he came ashore in midwinter, was seized with pneumonia in the right lung, and died. This case, which seemed to be one of inherited syphilitic lung disease, was benefited by sea air without any specific treatment.

I do not claim that I have positive proof of the origin of the lung trouble in the cases noted. My reasons for believing the first four cases to have been syphilitic phthisis are:

1st. No symptoms of marked pneumonia preceded the chronic phthisis.

2d. The lung trouble followed syphilitic contamination and constitutional symptoms.

3d. The disease was, to some extent, influenced by specific treatment.

4th. There was no tendency to tuberculosis.

Case V. seemed to be hereditary specific lung trouble.

How shall we determine a case to be one of syphilitic phthisis?

Dr. William H. Porter, in an interesting and instructive article in the *Quarterly Bulletin of the Clinical Society of the New York Post-Graduate Medical School and Hospital* for August, 1885, says:

"The diagnosis is based upon five principal signs and symptoms:

"1st. The abundant expectoration without any signs of softening of the pulmonary tissue.

"2d. The weak and debilitated condition without marked emaciation, and the good rational history of phthisis.

"3d. Pronounced dyspnœa, without any evidence of a cardiac or pulmonary obstruction to the circulation.

"4th. The peculiar pain, and the reaction to pressure upon the sternum and tibial crests.

"5th. The ready response to treatment is another element in the diagnosis."

He also noticed that the tubercle bacillus was absent in the cases examined by him.

What are the conditions of the atmosphere at the sea-level, which are not present at an elevated location elsewhere?

1st. It contains more moisture.

2d. It is denser.

3d. It contains some degree of saline impregnation.

4th. It also contains a small quantity of iodine.

What influence would these conditions have upon the diseased lung structures?

The condensed atmosphere, and the dampness, associated with the saltness, would probably increase the circulation of blood in the diseased lung, thus hastening the breaking-down process in a tuberculous lung; while, perhaps, in the syphilitic lung, the increased circulation might exert a favorable influence upon the disease, by increasing the nutrition of the lung. The constant inhalation of the minute amount of iodine could, perhaps, assist in influencing the disease. (A physician informed me that he had observed at the seashore after a storm, that the starch in his shirt had turned blue from the iodine in the air.)

Dr. Porter, in his paper referred to (in which he gives his observations on one hundred cases of specific lung disease), states that in many cases the dyspnœa is not due to congestion or stagnation of blood in the lungs.

The cases which I have given are offered in the hope of stimulating observation in this direction, which may result in removing doubt as to the efficacy of sea air on syphilitic lung troubles. These cases certainly prove that, in some instances, phthisis, complicated with constitutional syphilis, is benefited by sea air.

With the strides now being made in diagnosis I am sure that the developments of the near future will be such as to enable us to determine positively syphilitic lung disease, and then the question raised in this paper can be definitely settled.

DISCUSSION.

Dr. E. T. Bruen, of Philadelphia, said: I rise to speak to one point brought up by Dr. Curtin. It is very important that we should have clear ideas with reference to the influence of sea air on pulmonary processes. It has occurred to me that when phthisis is engrafted upon a syphilitic subject, it is generally due to the fact that in syphilis the tissues are very prone to catarrhal inflammation, and that the products thus formed constitute a suitable culture medium for the bacillus of tuberculosis. The benefit of ocean voyages upon the lungs of syphilitic subjects is attributable to the good effect of sea air upon catarrhal processes in the mucous membranes generally. It seems to me that in acute and chronic bronchitis, residence in an insular climate, a sea voyage, or even a stay at the seashore, is markedly salutory. On the other hand, in tubercular phthisis, it has been my experience that the sea air was injurious, although in cases in which catarrhal processes are marked, the ozone present in the sea air is antagonistic to the organisms which keep up the catarrhal process. In acute tubercular phthisis the moisture of the air at the seaside is favorable to the development of the bacilli, which probably have a decided effect upon the progress of tubercular phthisis. On the other hand, places in the pine forests, where the air is very dry, as, for instance, in the latitude of San Antonio, Texas, the pine woods of North and South Carolina, and the New Jersey pine forests, the dryness of the air is antagonistic to the bacillus of the tuberculosis. My feeling has always been adverse to advising patients suffering with true phthisis to make any prolonged stay at the seashore. When, however, I have believed that there was an inflammatory type of the disease, or so-called syphilitic phthisis or bronchial catarrh, the atmospheric conditions found at the seashore or on a sea voyage are beneficial. Many patients suffering with tubercular phthisis are advised to take sea voyages. From my experience with phthisis, I should say that those cases which are benefited by prolonged sea voyages, are those which have no marked inherited tendency to tuberculosis, but in whom, as the result of overwork or worry, the vitality of the tissues has become so reduced that they become good culture media for the bacillus. These are the cases in which there is usually a marked catarrhal element, and they can be sent on a sea voyage with benefit.

Before sitting down, I would say one word more. I have seen phthisis develop among college students who have been much confined in badly ventilated rooms, and in several instances positive benefit has followed a sea voyage. The hereditary tendency in these cases was not marked, although the bacillus was found in the sputa. Still they could not be regarded as cases of tubercular phthisis.

Dr. V. Y. Bowditch, of Boston, said: I should make a distinction when speaking of sea-coast air and pure sea air. I should not recommend a person with any sort of phthisis to remain long at any place on our harsh New England coast. I have known cases to improve upon the open sea. We

are unable to say what the exact difference is. In one of the cases related by the author, I think that the patient improved when on an island two miles from the sea-coast. Similar cases have been reported where patients have done well on the Isle of Shoals, fourteen miles from the coast. A strong distinction should be made between the air of the sea-coast and that of the open sea.

Dr. F. I. Knight, of Boston, said: I am sure that the feeling among us is strong that the coast climate is objectionable for all forms of phthisis, yet I must say that I have seen well-marked cases of tubercular phthisis, with perhaps some hereditary tendency, do as well on our New England shore during the hot months as anywhere else. I, however, always try to keep them away. One of the most remarkable cases was that of a young lady who had most unfavorable symptoms. I advised her to go to the mountains, but she insisted upon going to Magnolia Beach, which is one of the coldest and most exposed parts of the coast. In one season she gained enormously, and her friends thought that she was well, but she afterward succumbed to the disease. As far as the totality of experience goes, I would recommend the mountains for suitable cases of phthisis, especially early cases, free from fever and nervous dyscrasia. There is a vast distinction to be made between the early and late stages. Not enough distinction has been made in this regard. In cases where the mountain climate seemed unadvisable, I have tried the effect of a prolonged sea voyage, or of an island climate. On the coast there are great vicissitudes and alternations between heat and cold, which are escaped on the sea.

Dr. W. E. Ford, of Utica, said: It is generally admitted by those who have studied the matter, that syphilis is a disease which is self-limiting, that after from two to three and a half years the only results that remain are found in the glandular system. If there is anything of syphilis left in the human body, it must be glandular enlargement or changes. These need not necessarily supervene. It seems to me that here phthisis would run about the same course as in a patient previously weak, or in those cases of weak hereditary constitutions where the glandular disease has been present in early childhood. I fail to see why sea air should be especially favorable in old cases of syphilis.

The experience of patients sent to the sea coast is about this: Those who suffer from purely catarrhal phthisis, or where the catarrhal element predominates, are not benefited. Although the amount of consolidation is small, the decline in general health will be marked. Cases in which the catarrhal element does not prevail, and which might possibly be termed fibrous phthisis, do well, and they do better on a sea voyage away from the misty coast. Very curious results are obtained at some of the hospitals which are found in the south of England. One of these is at Ventnor, Isle of Wight. It is said there that the climate is comparatively equable, and the barometric pressure is great. The amount of moisture is exceedingly small, owing to the presence of the chalk cliffs, which rise immediately back of the hospital, and prevent the ocean reaching that point. I have been

impressed with the fact that the advantage is not derived from sending the patient to the mountains or to the sea, but it is from sending him to a climate in which he can exercise out of doors. He should select a climate that is equable, so that he can be much out of doors.

Dr. J. C. Wilson, of Philadelphia, said: What I have to say is somewhat aside from the subject of the paper. I have no personal knowledge of syphilitic phthisis. I should, however, like to say a word or two about the patients who cannot go to our exposed Atlantic coast without risk. Of course, the difference between a sea climate and a seashore climate is very great. The conditions are essentially different. A patient who might be benefited by a long sea voyage might suffer disastrous consequences from a sojourn on an exposed sea coast.

There are three classes of patients, who, according to my experience, should not be sent to the sea-coast. The first includes all patients who have an active febrile movement. The very changes brought about by a sojourn at the seashore tend to increase the tendency to fever. The second group includes those highly excitable, neurotic patients readily disturbed by any abrupt change of climate or surroundings. Such patients do not do well at the seashore. The third class includes those who are liable to repeated attacks of blood-spitting. Such patients are in danger of having the hemorrhagic tendency increased by a sojourn at the seashore. I believe that the cause of the bad effects in these three classes is near at hand. The alterations in the land and sea breezes, with the accompanying changes in temperature, increase the tendency to fever, subject the patient to the risk of local congestions, and tend to produce nervous excitement; while there appears to be something in the stimulating effect of the air which favors the occurrence of hemorrhage. I am satisfied from my experience that the three classes of cases which I have mentioned cannot, with safety, be sent to our Atlantic sea-coast.

Dr. F. C. Shattuck, of Boston, said: I think that I understand the author of the paper to advocate the view that there is such a disease as syphilitic phthisis—that is to say, a destructive process in the lung which is not tubercular, but due to the syphilitic virus. This is a matter about which there is a good deal of dispute, and one which is not yet definitely settled. Clinically, I do not know how we are to determine it from the symptoms, for there is such a great variation between different cases of phthisis which are undoubtedly tubercular. I think that very little importance is to be attached to the presence of a little more or a little less dyspnœa, or the occurrence of more or of less expectoration. We have all seen patients with slight local lesions and tremendous constitutional symptoms. We see other patients with very extensive local disease and trifling constitutional manifestations. The variations are so great, that, as I have said, much importance cannot be attached to them. It would seem that the criterion must be the presence or absence of the bacillus tuberculosis. The discovery of this organism is too recent, and the time is too short since the methods of examination have become the common property of the profession, to enable

the question as to the existence or non-existence of syphilitic phthisis to be decided. I understand the author to quote Dr. Porter as having examined the sputa from one hundred cases without finding the bacilli. That number is so large for the time which this test has been available, as to make one a little doubtful as to the method. The fact that the bacilli are not found is no proof that they are not there. It is a question whether or not the rapid method of Gibbes is reliable. If the bacilli are present in large number, and the operator is unlucky, and does not strike the right portion of the sputum, the bacilli will be overlooked. The only safe way is to use the slow method of Ehrlich or of Koch himself. Syphilis and tuberculosis are both very common diseases, neither of which confers any immunity against the other.

Dr. J. H. Musser, of Philadelphia said: I am glad that Dr. Shattuck has introduced this phase of the subject, for it is one of great importance. I am quite in accord with him as regards clinical experience. In a fair experience in the study of pulmonary phthisis, I have never seen a case of pulmonary phthisis resembling pulmonary tuberculosis which I thought to be of syphilitic origin. In a moderately large experience in the post-mortem room, I have met with only one case in which the lesions at all resembled those which might be due to syphilitic phthisis. The case was that of a man twenty-two years of age, who had had syphilis and cirrhosis of the liver. There was a syphilitic gumma in the brain, and the patient died of syphilitic meningitis. There were found scattered through both lungs innumerable miliary granules. These were solid bodies, made up of a central yellow core, which was moderately firm, and this was surrounded by a ring which made up about one-half of the entire body. These patches were found to be made up of firm fibrous connective tissue, in the centre of which were granular matter and degenerated cells. The sections were made by accomplished microscopists. We were unable to find the bacillus of Lustgarten, which was referred to by Dr. Porter as diagnostic, nor did we find the bacillus tuberculosis, but, as has been stated, the fact that it was not found is not positive evidence that it was not there. These nodules were scattered throughout the parenchyma of the lung, but did not seriously interfere with the structure of the lung. There was associated with them an alveolar catarrh. I should not call this a case of syphilitic phthisis, but rather a case of syphilis of the lung. Climate might have benefited the catarrh, but I do not see that anything short of iodide of potassium would have stopped the growth of the nodules.

Dr. E. Fletcher Ingals, of Chicago, said: I was much interested in the remarks of my friend from Boston, with reference to the practicability of diagnosing cases of syphilitic phthisis. I apprehend that often it is not practicable, yet all of us have seen cases in which there would be no question in regard to this matter. In my experience I recall a number of cases in which the syphilitic nature of the disease seemed unquestionable. The absence of tubercle bacilli is not so very important in diagnosis, for they may not be found if present, or they may be present even in syphilitic cases.

If a case is syphilitic in its origin, there is nothing to prevent it from becoming tubercular.

As to the question of the self-limitation of syphilis, there is a good deal of difference of opinion. I think that about one-half of the medical profession believe that syphilis can be cured, while the other half think that it cannot be cured. I have had patients come to me with new and unmistakable evidences of the disease, five, ten, and even twenty years after they were supposed to have been cured. I recall one case in which the syphilitic manifestations were very pronounced, which was of special interest, because of the apparently injurious effects of high altitudes. There was marked consolidation of one lung, particularly of the middle portion, about three-fifths of the whole organ being involved. The patient was greatly emaciated, suffered much from cough, and presented in every way a phthisical appearance, excepting the peculiar pallor. There were other evidences of syphilis upon the surface, and he had a distinct history. He had been in Colorado, but had grown a great deal worse while in that high altitude. He returned to a comparatively low altitude, and under the use of iodide of potassium in large doses apparently recovered. He was under my observation for about two years, at the end of which time he was able to return to his work.

In considering the climatic treatment of phthisis, there are two or three points which suggest themselves to me. There seems to be a general impression that out-of-door life is particularly beneficial for those who have a predisposition to phthisis. I have no doubt that this is true. Why it is beneficial is a question which I have often asked myself. It seems to me that it is beneficial simply as it improves the general condition, so that the patient is better able to stand exposure. As one of the proofs of the benefits of out-door life, I think that in most text-books it is claimed that farmers are rarely affected with phthisis. This, I believe, is a mistake which is to be explained in this way. Most physicians who make records of cases live in the cities, and treat comparatively few patients from the farming districts, as the country practitioners take care of them. It has been my observation among farmers, confirmed by physicians practising among them, that many living in the open country are affected with phthisis. I doubt whether the number per thousand is any less than in the city.

There is also a generally accepted idea that phthisis is more common at the seashore, and that patients with this disease do worse near the ocean than inland. Why should this be? Is it the amount of moisture, the sudden changes of temperature, or something else? A few years ago I had occasion to examine the statistics of different parts of the United States, and I was surprised at the result. I found that the deaths per thousand from phthisis were about as follows: Boston, 18; New York, 16; San Francisco, 15; New Orleans, 14; Charleston, 13; Cincinnati, 13; Philadelphia not far different from the other cities. When I examined the statistics from St. Louis, Chicago, and Buffalo, I was surprised to find that the rate was only about eight per thousand. When we recall the fact that Buffalo and Chicago are situated on great inland lakes, and subject to great changes in temperature,

on rare occasions amounting to fifty degrees in a few hours, it seems certain that changes in temperature cannot be the reason for the great prevalence of phthisis at the seashore. The moisture also would seem nearly as great on the shores of the inland lakes as it is at the seashore. How then may we account for the difference in the prevalence of this affection near the ocean and inland?

Dr. Frank Donaldson, Jr., of Baltimore, said: One of the gentlemen speaking, I noticed, attributed all the good which followed in phthisical cases removal to high altitudes, exercise and sunlight. That is too broad a statement. I am informed that if you take an animal from a low to a higher altitude, as, for instance, Colorado Springs, it will at first suffer with dyspnœa, but in a short time it will be able to do infinitely more work in a day than before. This would seem to show that there is certainly something more than sunlight and exercise, which greatly improves vital functions in a mountain region.

DISEASED CONDITIONS FOR WHICH SEA AIR IS OF DOUBTFUL BENEFIT.

By BOARDMAN REED, M.D.,
OF ATLANTIC CITY, N. J.; FORMERLY PHYSICIAN TO THE MERCER MEMORIAL HOUSE FOR INVALID WOMEN.

Sea air is so generally beneficial as a tonic and alterative that there is a possibility of overlooking the fact that it does not favorably influence every diseased condition. Physicians are constantly prescribing it, and nearly always with an intelligent idea of the effects likely to be produced, but it is a pleasant and increasing popular remedy which patients are very fond of prescribing for themselves, and sometimes for maladies or stages of disease which it cannot benefit. The interests of medical science demand that the indications for sea air should be defined with as much exactness as possible. It devolves upon us, as students of climatology, and especially upon those of us who reside at the seashore resorts, first to observe carefully the effects of sea air, and then to classify and record our observations. Patients frequently spend a few weeks at the shore and return home no better or worse than before, though the climate was perfectly suited to them, and should have proved helpful. For instance, sufferers from hepatic or gastric derangements, or from nervous depression due to such derangements, may indulge inordinately the enormous appetite which is nearly always produced by sea air. They will often go through nearly the entire elaborate bill of fare, day after day, at the leading hotels, with the result of bringing on attacks of acute indigestion, gout, diarrhœa, sleeplessness, or other sequelæ of such imprudences, and attribute it all to the noxious properties of the air. Others, convalescing from severe illness, insist upon sitting upon the wet sand at Atlantic City for hours in February and March, or driving for miles against a cutting March wind, even during the occasional cold waves, and then anathematize the climate, which has not prevented them from contracting a rheumatism or bronchitis. Still others, with weak vasomotor nerve centres, and a tendency of blood to the brain, take

prolonged hot baths without medical supervision, and thus cause cerebral congestion, or even apoplexy.

The foregoing are a few of the imprudences by which patients prevent themselves from improving at the seashore, when, with proper precautions, they should do well there. There are other incidental conditions, such as those pertaining to the location of their hotel or residence, whether near the beach or further removed from it, the amount of clothing worn, the kind and amount of exercise taken, and even the character of companions associated with, whether cheerful or hypochondriacal, all of which affect, more or less decidedly, the progress of a patient at a seashore resort.

But, aside from these various incidental influences, there are diseases for which sea air is not especially beneficial. In some few morbid conditions, particularly when far advanced, aggravation may be feared. In others, it is a matter of individual idiosyncrasy whether benefit or harm shall result from a sojourn at the shore. Sea voyages, involving contraindications apart from the quality of the air, are not included in this discussion.

The disease which, in certain of its forms, is liable to the most pronounced and undoubted aggravation at the seashore is bronchial asthma. It happens occasionally that an asthmatic patient, who arrives by the evening train at a seaside hotel, is obliged, after a night of exceptionally severe dyspnœa, to hurry away in the morning. On the other hand, many cases are most distinctly and positively benefited by sea air. I have known numerous asthmatics who enjoyed entire immunity from their affliction while residing at Atlantic City. There seems to be no sign or symptom by which the physician may determine in advance which cases will be benefited and which aggravated.

Diseases of the upper air-passages should be included in the doubtful list. In occasional cases, in which the mucous membranes of the nasopharynx and larynx seem to be abnormally sensitive, sea air proves too stimulating. In other cases of chronic catarrh of the same tract we may hope for benefit, especially in summer, when sea-bathing, to a moderate extent, forms a part of the daily routine. But, even in winter and spring, I see many subjects of catarrh improve steadily at the shore, as they gain in nutrition and general nerve tone.

Pulmonary phthisis, as shown by the writer in previous papers, is usually influenced favorably by sea air up to a certain point. During its incipiency, and during the whole of the first stage, improvement may be nearly always expected at Atlantic City. With proper atten-

tion to dress and other hygienic matters, the cough diminishes, the appetite increases, sleep is sounder and more refreshing, the whole system is invigorated, and there is a gain in the body weight. This is the rule, aggravation of the condition the exception; but, after softening begins, it is the other way. Improvement is the exception, a more or less downward tendency the rule. Chronic, or slowly progressing cases of phthisis in the second stage, may do well at the seashore, but until the introduction of the Bergeon method of injecting antiseptic gases into the bowel, the majority of even selected cases there, as elsewhere, followed the too familiar downward course, with occasional intervals of arrest and improvement. The gaseous enemata, which have been used in my practice since early in April, promise to do more for phthisis at the seaside than in any of the large cities. Patients in favorable localities of the shore are surrounded by a much more nearly aseptic air, and if we have at last found an agent by which the destructive process in the lung can be directly and hopefully antagonized, whether by actually destroying the bacilli tuberculosis, or otherwise, the curative results should be the best, other things being equal, in that atmosphere which presents the least danger of constant reinfection of the system from without.

The advanced stages of heart diseases are liable to be aggravated by the overstimulating or exciting effect of sea air. Cases of extreme dilatation, or fatty degeneration, especially when general anasarca has supervened, cannot, as a rule, be removed to the shore with any hope of betterment.

Patients who suffer from violent neuralgias whenever the wind is from the eastward, or before the oncoming of storms, may experience aggravation when they first go to the seaside. After a longer stay, when the roborant effects of the air have fortified their nervous systems, with or without the help of some judicious medical treatment, marked improvement may be expected.

Resident physicians at the seashore are often asked whether rheumatism is benefited there. It is a difficult question to answer satisfactorily. Reasoning on *a priori* grounds, we should expect the comparative dampness of most seaside places to disagree, and it is not unusual to meet with rheumatic patients who consider themselves worse at these localities. The result of my experience, however, is that the majority of cases at Atlantic City, when kept on proper diet and under suitable drug treatment, are favorably influenced there. As in most chronic affections, improvement may be expected, *pari passu*, with gain in the general nutrition; and there is probably no

climate which conduces more powerfully to such a gain than that of a favorably situated seaside resort.

The hot sea-water baths which visitors to the shore may now enjoy, both in winter and summer, are probably more beneficial in rheumatism than any other class of affections. Sand baths in the summer months are believed to have curative properties in the same disease. It is probable that these baths of both sea water and sea sand, as well as the strongest sea air, produce some alterative influence upon the system in consequence of the iodine, chlorine, etc., which they contain.

Other physicians have assured me that they have observed a number of acute skin diseases to be aggravated by sea air. I have seen cases of urticaria which were exceedingly rebellious to treatment, but recovered promptly on returning to their homes and their own physicians. Whether it was the change of climate, or change of doctors which cured them, must remain somewhat in doubt, but it has come to be a fixed belief with me, that urticaria is apt to be worse at the shore than inland. I cannot recall any experience which would indicate that the same is true of any other skin disease.

It is thus seen that there are very few positive and well-determined contraindications for sea air. There is, perhaps, no single disease which a patient may not have in some of its forms or stages, and yet hope for benefit at a suitable seaside place; but there are numerous morbid conditions for which sea air is not notably curative, and several, including especially the most advanced stages of phthisis and of organic cardiac lesions, which cannot be improved, and may be injuriously affected by removal to the seashore.

THE TREATMENT OF THE FINAL STAGES OF PHTHISIS.

By J. H. MUSSER, M.D.,
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The treatment of phthisis is of the most intense interest to the busy practitioner. No discourses in medicine are received with more avidity than those which detail a new method for the treatment of consumption, or hurl forth a new specific for its cure. The reason is obvious. But it is quite true, also, that a very large, indeed, too large a share of the monographs deal with the incipient stage of phthisis, but leave the treatment of the final stage to be evolved from the more or less limited experience of the practitioner. In fine, it is too often forgotten that we must alleviate suffering as well as cure disease. The burden of the subsequent, without a doubt most trite, remarks applies to the treatment of the final stage. Neither the first, nor the second, nor the third stage in its entirety, will be considered: only that portion of the third stage which precedes the finale. The racking torment of the beginning has passed; the dreadful anguish of the middle period is gone; the third period is fast waning, and that slowly creeping march of suffering and forbearance, filled with the inspiration of hope, has begun, to end only in the grave.

What are we to do in these final hours of suffering? Are we able to meet the demands upon us? Is the profession sufficiently taught to administer to the comfort of these afflicted ones? In vain does one look to the monographs and journals for suggestions; no words are uttered in the lecture-room; for aught we gather from medical literature the care of the patient dying of phthisis devolves entirely upon the nurse. Those of us who are hospital physicians alone can scarcely appreciate the mental anxiety and emotional distress of him who daily administers to the want of a patient, too often a friend, dying of this disease. It is easy for the *chêf* to leave such duties to the interne or the nurse. Quite different, however, for the family practitioner. In these cases, above all others, the powers of the true physician are

beautifully displayed. Here it is that the exercise of the high and holy qualities typified of old by the Master Physician are essential.

Yet, withal, a thorough knowledge of therapeutics is required for the pain that is here, and the ache that is there; for the cough of to-day, and the laryngeal spasm of to-morrow; for the dyspnœa of manifold causes; for the vomiting in the morning and the retching at night; for fever and sweating; for wakefulness and sleep; for the thousand and one ills—to relieve which the physician must have a mind fertile of expedient, and abundant of resource.

The suggestions regarding the management of the last stage of phthisis are derived alone from the writer's personal experience; much more profitable though it would be, time prevents detailing the experience of others.

External symptoms.—For the relief of erythema from pressure and moisture, remove the cause, if possible, apply astringent lotions and drying powders. The extract of hamamelis diluted, or the aqueous extract of the shops; borax and alcohol; the latter alone; sulphate of zinc, twenty grains to a pint of water; alum and water; carbolic acid (ten drops) in water (Oj); or alum and alcohol carefully applied, is grateful and remedial. Starch, rye flour, fullers' earth, oxide of zinc, subnitrate of bismuth, iodoform, and starch, are drying powders, named in the order of cheapness, that are efficient. For painful erythemata, iodoform 1 part, oxide of zinc 2 parts, subnitrate of bismuth 2 parts, and starch 4 parts, answer well.

A saturated solution of iodoform in ether, applied every day, or every other day, seems to relieve pain and remove congestion. A mixture of iodoform and surgical collodion relieves pain quickly. One must not forget the conventional soap-plasters, while glycerine, applied frequently, is also of service. Ointments of iodoform, or of zinc, with the extract of opium or belladonna, are often necessary. For bedsores remove pressure, and apply, by dusting, iodoform, Peruvian bark, oxide of zinc, or subiodide of bismuth. Oakum saturated with balsam of Peru is often excellent. Surgical principles will guide in the treatment of exceptional ulcers.

Œdema of the legs is frequently most distressing; bandages and elevation of the limbs are required. The swollen legs are the seat of a very painful erythema; here again, sedatives, as laudanum, and lead water, or hamamelis, are required. One of the easiest prepared and most soothing applications for any œdematous erythema, is the so-called starch poultice; ordinary starch mixed with water to the consistency of thick cream, spread on linen, and applied.

Apart from the usual pains in the thorax, the patient suffers from general aching and soreness, and from local areas of pain. Rubbing with stimulating applications, alcohol, soap liniment, arnica, chloroform liniment, or with dry heat, or applying hot flannels, is necessary. Local pains may be relieved, if in the course of the nerves, or in the extremities, or where undue pressure has been exerted, by cannabis indica; laudanum may also be used, but is inferior in value; lanoline is a good vehicle for any substance. Plasters are not generally pleasant; belladonna, opium, and soap may be selected.

Chest pains are usually severe. Use dry heat, by means of hot cloths, hot plates, or hot water bags, or sinapisms, or rubefacient liniments. Pain in the epigastrium and about the heart often occurs in the last week, and is most horrible; dry heat is the most serviceable of external applications. The pain appears to be due to tension on the adherent pleura by collapsing or contracting cavities. The secret of success in the treatment of the general and local pains, is the ability to ring the changes on various articles; the wrought-up nervous system, conjures up, or intensifies pains, which require an agile mind to relieve.

Gastro-intestinal symptoms.—For the dry, parched, or fevered lips, use cold cream; camphorated or benzoated oxide of zinc; camphor water and glycerine, with or without borax, or boracic acid; or even glycerine alone. An erythematous stomatitis is often present; demulcents are required. Decoctions of marsh-mallow, or gum arabic, are soothing; morphia, or the syrup of poppies in a demulcent, relieves the burning distress. The slippery elm bark of boyhood days, chewed, furnishes a soothing coating to the mucous membrane. The burning that attends erythemata may be relieved by allowing bits of borax to dissolve in the mouth, or by applying boracic acid locally. Ten grains of the latter to half ounce each of water and camphor water are sufficient. Alkaline waters iced are grateful.

For ulcerative stomatitis and thrush, phenol sodique, Dobell's solution, and Listerine, either of them well diluted, are detergent, and often soothing. If the ulcers are few, iodoform in ether touched on them will quickly heal. Boracic acid and camphor water in distilled water is a cooling mouth-wash; myrrh is commonly used by the laity. Alcohol in water can be used; a solution of the bichloride of mercury (1 : 1000) in iced water seems to be cleansing. Flatulency is a most distressing cause of suffering. External applications of heat, dry or moist, are required. The aromatic spirits of ammonia, spirits of chloroform, Hoffmann's anodyne, brandy and lime-water, creasote

and charcoal in pill, with or without pepsin, or a mixture of carbolic acid, tincture of cardamon, bicarbonate of soda, with mint water, most frequently relieve it. The recent preparations of pepsin, and pancreatin, are of inestimable value. A bitter before eating, with or without an alkali, prevents a succeeding flatulency; either nux vomica, gentian, or quassia.

Vomiting arises from laryngeal irritation, from cough, from exhaustion, from local gastric irritation by undigested food undergoing fermentation. Remove the laryngeal irritation by the local application of astringents and anodynes, by glycerite of tannin with or without morphia, or by astringent and anodyne lozenges. The vomiting of food by cough is prevented by administering morphia half an hour before meals, or by taking deodorized tincture of opium before the meal. The vomiting that occurs after rising is often prevented by taking some stimulant with nourishment, before assuming the erect posture: sherry and egg, or milk and brandy. The vomiting and retching that occur from excessive coughing is to be relieved by the anodyne that checks the cough; the more simple the anodyne the better; minute doses of morphia, if not contraindicated, are the best. The vomiting of exhaustion is controlled by stomachics, as quassia, or gentian in infusion; by stimulants, as champagne, brandy, and aromatic spirits of ammonia. Vomiting due to local irritation and congestion, caused by undigested and fermented food, is relieved by antifermentatives: carbolic acid, creasote, bismuth, and charcoal; by artificial aids to digestion, by the use of peptonized or pancreatized foods; by alkalies, as iced lime-water, or Vichy water, which act as local sedatives; by carbonic acid water, the effects of which are sedative. The stimulating effect of a sinapism, or the sedative effect of a blister, must be invoked by their respective indications. It must not be forgotten that lying on the right side increases the tendency to vomit, lying on the other side having an opposite effect.

Pain in the epigastrium, a most common symptom from flatulency, from an irritated congested stomach, from a diaphragmatic pleurisy, is to be met by treating the respective causes. A gastric sedative, as subnitrate of silver in pill before meals, with a minute dose of opium, prevents the pain that ensues after food.

Diarrhœa, if colliquative, may be controlled by stimulants, as burnt brandy, ammonia, or camphor; if tubercular, by large doses of astringents. Bismuth, from thirty to sixty grains in each administration, has served the writer as well as any combination of drugs. Logwood

is a most valuable astringent the fluid extract being used most frequently.

Intestinal flatulency is often the cause of diarrhœa, and can be prevented by salicylic acid, by antifermentatives, and by pancreatin. The diarrhœa that follows immediately on taking food is treated by an opiate; preferably, deodorized tincture of opium in small doses, five to ten drops, or the powder one-twelfth of a grain, with silver or bismuth, before meals. A septic diarrhœa ensues also in the last stage, and is to be checked by salicylic acid, by naphthol, or other forms of the naphthaline series recently introduced into therapeutics. The diarrhœa of amyloid diseases can only be controlled by opiates.

To relieve the cough of the last stage is most difficult. Dryness of the upper air-passages is most distressing, and local applications are generally painful. By the aid of a mirror, suitable remedies, always demulcent in character, can be applied to the congested areas about the larynx and epiglottis. Glycerine applied with a brush relieves the dryness; Dobell's solution thus applied is of service. The applications must be made often to the dry areas. Listerine with glycerine is of much value. Inhalations of terebinthinated vapors, or of simple aqueous vapors, are most grateful. The simplest form of inhalation is the best. We frequently have generated the vapor in a sick cup, covering the top and inhaling by the mouth-piece. The ineffectual efforts to cough can be aided by hot water, by hot water and brandy, and by the aromatic spirits of ammonia well diluted. Hydrocyanic acid has never been of any service in my hands for cough, while opiates are to be used with caution. A moderate dose of morphia may produce serious, even fatal symptoms. Codeia has disappointed the writer. Hyoscyamus and belladonna frequently add to the distress by producing dryness of the fauces; to relieve the dyspnœa, our utmost efforts are in demand. Ammonia, alcohol, Hoffmann's anodyne, and draughts of hot water are required in turn; external heat contributes to the relief. One of my professional friends says he has seen the air-hunger relieved by quebracho. Inhalations of oxygen should be theoretically of much service; the writer has never used them. The patient must be supplied with fresh, cool air, a source of relief to the distress. Attacks of dyspnœa, of course, are increased by flatulency, and this complication must be removed.

Hemorrhage in the last stage is usually profuse. A knowledge of the pathological anatomy of the lung at once shows the futility of astringents. Rest and opiates are essential, stimulants may be

required; ice or cold cloths over the chest are imperatively demanded if it persists.

Laryngeal and faucial tuberculosis increases the distress of the patient. As long as feasible, cocaine to render the taking of food possible must be applied to the ulcerated pharynx and larynx. Insufflations of morphia alone, or with iodoform and starch, must be practised, and over the larynx frequent fly blisters applied. One-eighth to one-quarter of a grain of morphia, with one grain of iodoform, and three of starch, insufflated, or added to treacle and retained by the patient as long as possible in the larynx, gives much relief.

In the late stage of phthisis some means must be used, but not as imperatively as in the earliest stages, to combat fever. Quinine frequently aggravates nervousness, and is inadvisable. The salicylate of sodium, doses of five grains, guarded with a drachm of whiskey, every three hours, is a reliable antipyretic. It is also of much service after the manner of administration by Jaccoud. The general restlessness and nervousness which ensue at this period of phthisis must be prevented or allayed by quiet in the surroundings, by free access of pure air, by the administration of light liquid food only, and by the use of stimulating anodynes, preferably Hoffmann's anodyne; for a similar purpose, valerian and asafœtida, by the mouth or rectum, or, if practicable, musk can be used; they are of much value. Gentle frictions allay restlessness, while ministrations with soft voice and gentle action allay an easily perturbed, nervous system. By means akin to these, we can truly administer to the sufferings of our patients. It is quite certain, however, that the firm voice, the truthful countenance, the inspiring touch, sustain and soothe in this trying passage through the valley of the shadow of death.

DISCUSSION.

Dr. V. Y. Bowditch, of Boston, said: The author has referred to the use of antifebrin, but I notice that he does not speak of the excessive sweating which it often induces. In three cases in which I used antifebrin, in five grain doses, the sweating was so great that I did not think it worth while to continue the use of the drug.

ON THE CAUSES OF CARDIAC FAILURE IN HIGH ALTITUDES.

By FRANK DONALDSON, Jr., B.A., M.D.,

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The extreme importance of this fact, that there is so often, not only in the weak and diseased, but also in the strong and healthy, great dyspnœa and sudden cardiac failure in high altitudes, has not, I venture to assert, been sufficiently emphasized. It is not too broad a statement that many persons are sent for general or special reasons to high altitudes, who are done thereby permanent injury—especially may this be the case with those who are suffering with any form of functional or organic heart disease. That such a procedure was or might be dangerous was forcibly impressed upon me in the course of some experiments (with the pneumatic cabinet) for the effect of rarefied and compressed air upon the heart and circulation; and upon purely scientific grounds I declared in this Society a year ago that, before deciding a person to be a proper subject for treatment by rarefied or compressed air, *thorough examination* should be made of the *heart; and that no person found to have insufficiency or stenosis of the mitral or aortic valve, or the slightest tricuspid regurgitation, or a fatty or weak heart, should, under any condition, be subjected to treatment by rarefied and compressed air.*

You, doubtless, remember a paper by Prof. Loomis, read at our last meeting, "On the Effects of High Altitudes on Cardiac Diseases," in which he gave the history of six (he had then recorded twenty-two) cases of cardiac failure directly due to removal to a high altitude. In this paper Dr. Loomis says:

"In these cases which I have quoted, as well as similar ones which have come under my observation, *the ventricular dilatation,* which was unquestionably the cause of the sudden development of the distressing symptoms, and from which dated the commencement of the fatal issue, seemed to be directly due to the effects on the *cardiac circulation of the change from a low to a high*

altitude. I do not maintain that sudden cardiac dilatation might not have developed in any one of these cases under other conditions, but I do maintain that change in atmospheric pressure is a very important cause of sudden ventricular dilatation when any degree of heart insufficiency preëxists."

Finally, he declares that only with danger can a person whose heart is weak, fatty, or diseased, pass rapidly from a low to a high altitude; and, indeed, I gather from his subsequent remarks that a person with cardiac disease should, under no circumstances be sent to high altitudes.

Dr. Loomis, then, had arrived at the same conclusion from clinical experience as the author had experimentally; and it seems that we may rest assured that there is great danger for the diseased heart, either in high altitudes or in any form of treatment by rarefied and compressed air. We are also supported in this conclusion by Dr. Solly, of Colorado Springs. In a conversation with the writer, Dr. Solly bore with great emphasis on the extreme danger to the weak or diseased heart of a sudden or even gradual removal to high altitudes, and that he was convinced, from many years' experience at Colorado Springs, that it was a precaution almost entirely neglected by the *average* practitioner.

The fact, then, would seem to admit of no doubt, both for scientific and clinical reasons. What, then, is the cause of this cardiac failure? It is very generally asserted that the cause of cardiac failure in high altitudes, in rarefied air, is the *want of oxygen.* That the system needing more oxygen, more blood has to be sent through the lungs in a given time, thus increasing the work to be done by the heart, which often dilates under the sudden strain. This explanation, so generally found in the text-books, though applicable for very high altitudes, is, at the same time, based on a misconception.

First. The partial pressure of oxygen at normal atmospheric pressure is equal to 150 millimetres of mercury.

Second. So long as the partial pressure of this gas remains above twenty-five millimetres of mercury (one inch) the amount taken up by the blood will depend upon the amount of hæmoglobin in that liquid, and not on how much oxygen there is in the air.

Third. The partial pressure of oxygen even at so great a height as 10,000 feet would be 101 millimetres of mercury, at which the hæmoglobin could get all the oxygen necessary.

But, it may be urged, Paul Bert found an increased amount of hæmoglobin in the blood of animals in high altitudes, which would show a necessity on the part of nature for more oxgen. True, but this

change takes place only after a very long time, probably not in one generation. Again, it may be objected that in many of those very cases sent to high altitudes the blood is poor in hæmoglobin. Doubtless this is true, but it is not the sick only, by any means, who suffer from dyspnœa and cardiac failure in high altitudes.

How may this clinical fact be more satisfactorily explained? However much the phenomena of normal quiet respiration may be changed in a highly rarefied atmosphere, the chief and immediate cause of dyspnœa and cardiac failure may, I think, be traced to *the diminished pressure on the heart walls and their consequent dilatation.* This fact may be made plain as follows:

The external air presses against the interior of the lungs with a pressure equal to that exerted on the same area by a column of mercury 760 millimetres high; it distends them and pushes them against the inside of the chest walls, the heart and great bloodvessels and contents of the thorax. The pressure thus exerted is not equal to that of the external air, since some of the total air pressure on the inside of the lungs is used up in overcoming their elasticity (equal to six millimetres of mercury), and it is only the residue, equal to a column of mercury 754 millimetres high, which pushes the lungs against the heart and great vessels. The actual pressure, then, on the heart walls, normally, is equal to 754 millimetres of mercury.

How is this pressure changed at an altitude, say, of 10,000 feet? The total pressure of the air at that altitude would be equal to a column of mercury 501 millimetres high. The pressure, then, upon the lungs and whole body would be lessened. But, as the person is breathing the same air as that around him, the respiratory act would be unchanged. Prof. Martin and the author found that neither the frequency nor depth of the respiratory act was changed in an animal placed in a rarefied atmosphere. There would be (as, again, we found) a slight fall in blood pressure, which would be very temporary; for the circulation being a system of closed tubes, is but little, if any, affected, and the pressure rises at once to the normal, owing to increased vasomotor action. There would be no increase of negative intrathoracic pressure. Finally, the only organ directly affected at moderate altitudes (of course, at very high altitudes, 12,000 to 18,000 feet, the dyspnœa from want of oxygen would be felt), say, from 3000 to 10,000 feet, would be the heart, and for this reason: as we have said, the pressure on the heart usually is equal to 754 millimetres of mercury. At an altitude of 10,000 feet, however, the general pressure being 501 millimetres, the pressure on the heart would be only 495 millimetres of

mercury. Now the arterial pressure, and, therefore, the intracardiac pressure, would be the same as when the pressure on the heart walls was 754 millimetres. But one result could follow such conditions, and that would be a stretching and dilatation of the heart walls—especially of the right side—and this is precisely what is found in many of those who go into high altitudes for their health or for other reasons, and what we found in experiments upon animals. The heart, weak and diseased possibly beforehand, is unable to stand such strain as is put upon its dilated walls, and so we find its contractions weak, intermittent, and irregular—we have the murmurs, the syncope, the dyspnœa, which are often so marked in high altitudes.

Of course, the want of oxygen is a great cause of the dyspnœa in very high altitudes; but we are quite justified, on physiological grounds, in saying that at the altitudes to which persons are ordinarily sent—three, four, six, seven, or even ten thousand feet—the hæmoglobin can take up all the oxygen the system needs.

Finally, then, and speaking purely from an experimental standpoint, I hold that there is danger to the weak and diseased heart, not only in the use of such apparatus as the pneumatic cabinet, but also in high altitudes; in which conclusion I am supported by the clinical experience of Prof. Loomis, and of Dr. Solly, of Colorado Springs.

And in this connection I might say that those gentlemen who are interested in the pneumatic cabinet ought certainly to have called more—I do not know that they have called any—attention to the great danger attending its use in cardiac disease. I shall accomplish the object of this short paper if I shall excite the comment and discussion on this most important point from some of the distinguished diagnosticians here present.

DISCUSSION.

Dr. B. F. Westbrook, of Brooklyn, said: I have listened with the most intense interest to this paper, which shows not only the exercise of the greatest scientific acumen, but a spirit of fairness and close attention, which we seldom get in our medical societies. I think that the conclusions, so far as the physiological researches go, are perfectly correct. The explanation of the effects of ascension in high altitudes upon the heart is, I think, correct. The point is just this: When a person ascends to a high altitude, the lungs are not materially affected by the diminished pressure. The hæmo-

globin is capable of taking up sufficient oxygen, and respiration is not materially affected, for there is sufficient oxygen to supply the blood. The heart is, however, differently situated. While the lungs admit air into them, so that the pressure on the inside and the outside is equalized, the heart does nothing of the kind. The heart loses the pressure of the incoming air. There is no diminished pressure within the heart, and there is a tendency to dilatation of the cardiac cavities.

I think, however, that the attempt to apply the same remarks to cases where compressed air is inhaled, while the patient sits in air at the ordinary pressure, or where air at the ordinary pressure is inhaled while sitting in the pneumatic cabinet under a diminished pressure, will not hold. The conditions are changed. If a man ascends a high mountain he has the rarefied air, both inside and outside of the body; but if a man goes into the cabinet, and has the air rarefied, and breathes ordinary air, or inhales compressed air while sitting in air of the ordinary pressure, the conditions are not the same. You have there a relative increase of pressure on the interior of the thorax. The pressure on the outside is either relatively or absolutely decreased. While the chest is undoubtedly dilated, and the lungs fully expanded, the pressure which does this at the same time presses on the heart, so that the heart is not subjected to the same loss of pressure that is experienced on going into a rarefied atmosphere where the same air is both inside and outside of the chest.

As a matter of practical experience, I have found that persons with mitral stenosis, or mitral regurgitation, with a tendency to pulmonary congestion, can be put into the pneumatic cabinet with safety. I have frequently done it, and these patients bear the treatment as well as any body else. The mitral stenosis, or regurgitation, tends to the production of pulmonary congestion, and the increased pressure on the bronchial mucous membrane tends to counteract any malign influence that otherwise might be exerted. In cases of great aortic regurgitation I could scarcely claim that the same rule holds good. I should hesitate very much before putting a patient with aortic regurgitation into the cabinet, or causing him to inhale compressed air.

Dr. H. F. Williams, of Brooklyn, said: One or two gentlemen have recently made experiments with the pneumatic cabinet on weak heart, and particularly on tobacco heart. The effect obtained has been similar to that of digitalis, and is probably the result of the influence on the circulation through the coronary arteries. In weak, flabby heart the judicious, careful exhibition of the pneumatic cabinet treatment will so stimulate the arterial circulation in the coronary arteries as to produce a strengthening of the ventricular contraction, and cause a most signal relief. Dr. Tiegel, of New York, was the first one to call my attention to this matter. His theory is that on account of the expansion of the lungs, the vessels become increased in diameter, and the flow of blood is facilitated, and in this way pulmonary congestion is relieved. His conclusions are, I think, true. I think that Dr. Westbrook is right in his remarks, and that mitral disease offers no

obstacle to the use of the cabinet. I refer, of course, to the "inspiratory differential act." If the cabinet should be resorted to as a measure for the relief of cardiac disease, it will be necessary to select one of the seven forces it is capable of generating. Dr. Donaldson has demonstrated the effect of altitude upon the cardiac circulation; now the act which simulates this, and with which it is identical, so far as barometric pressure is concerned, is "residual air expansion;" if, however, this should be demonstrated to produce a prolonged diastole in a weak heart, then the reverse act—*i. e.*, "residual air compression"—should relieve it.

Dr. S. S. Cohen, of Philadelphia, said: I have been extremely interested in Dr. Donaldson's paper, and would cordially agree with Dr. Westbrook in regard to the extreme accuracy and scientific acumen which the paper evidences. One point which I am glad has been so clearly made by the author's researches, though not perhaps by his comments, is the difference that exists between immersing a patient in a rare atmosphere, which he also breathes, and allowing him to breathe a rare atmosphere while he is in a dense one; or the reverse. This difference cannot be too strongly insisted upon. The effect of diminished pressure, such as the author has experimented with, is obvious. The heart and vessels have become habituated to the ordinary pressure of 754 or 760 millimetres of mercury, and when in the rare atmosphere this pressure becomes altered, there is necessarily a rupture of "the adjustment of internal and external conditions;" and that rupture means disease. If one is not already in possession of a diseased heart, he may escape serious consequences by the natural readjustment of his system to its environment; but even if the heart be perfectly normal, and the vessels strong, if he remain in an extremely rarefied atmosphere disease will develop.

Admitting this, we must not, however, forget that the conditions, when a patient inhales air at a pressure different from that of the atmosphere around him, are not the same as when he ascends to a great elevation. Nor in the pneumatic treatment of disease are the changes of pressure as great as those to which the author refers. Nor is the rarefied air-bath employed to any extent; in this country not at all, as there are no pneumatic chambers this side of the Atlantic. The very elaborate researches of Vonvivenot, in Lange's pneumatic chamber, and later those of Waldenburg, the great apostle of pneumatotherapy, upon this question of the effect upon the heart and circulation of changes of atmospheric pressure, have led many careful observers to recommend the inhalation of compressed air, at a pressure of from $\frac{1}{80}$ to $\frac{1}{30}$ of an atmosphere; equivalent to a rarefaction around the patient of 9.5 to 25 mm., as a therapeutic measure in the treatment of dilated heart. I have myself employed this measure recently, and have seen excellent results in the alleviation of dyspnœa due to defective circulation and stasis of the pulmonary circulation consequent upon dilatation of the heart. Waldenberg published in 1875 some very elaborate researches upon this point. Other German observers have confirmed his statements.

There is one point which I would submit to Dr. Donaldson as worthy of experimental test, for it may have an influence in producing dyspnœa at high altitudes independently of the heart failure, and independently of the alleged deficient oxidation of hæmoglobin. We know that the gaseous exchange between the carbon dioxide of the blood and the oxygen of the air in the pulmonary alveoli, is facilitated by the difference in the tension of the gases. The carbon dioxide, no matter how high we ascend, remains at the same tension, while the tension of the oxygen will be diminished. Theoretically, the exchange would seem to be effected in this way. I am not aware of any observations upon this point. If the theory be correct, the dyspnœa would then be in part due to the retention in the blood of carbon dioxide, its disassociation from the salts of the plasma, and its outward diffusion, being retarded by the diminished tension of respired air, necessarily then, of oxygen.

Dr. W. E. Ford, of Utica, said: It seems to me that the discussion should be carried one step farther, and having found this condition which occasionally occurs in cases of weak heart in high altitudes, and, possibly, under pneumatic treatment, the question arises, What are you going to do about it? Some years ago, I had the opportunity of observing a succession of accidents which happened in young people employed in an asylum, as a result of struggles with the insane. I should say that there were a dozen or twenty cases of heart failure, which occurred suddenly among young attendants, who were possibly overworked by reason of their struggles with violent patients early in their experience with the insane. I followed the histories of four or five of these cases through a period of four or five years. I should like to hear this part of the discussion continued. I remember the histories of three cases in which aortic leakage occurred to such an extent as to interfere with the patient's ability to go about, and for which it was necessary to relieve the attendant from duty for a period of from two to four months. I examined the hearts from time to time over a space of four years, and saw recovery take place. After three or four years there was no appreciable lesion and no discomfort. It seems to me that this whole subject is not very different from the accident which occasionally happens where a person takes a deep inspiration fixing the diaphragm and then attempts some great muscular effort. I would like to know if other cases of heart failure have been followed in this way.

Dr. J. T. Whittaker, of Cincinnati, said: The conditions occurring in a rarefied atmosphere and those found in the cabinet, where the air admitted to the interior of the body is not rarefied, are so different that they cannot be properly compared. It would not seem possible to exert any mechanical pressure on the heart in the cabinet. The first thing that occurs is great expansion of the chest and liberation of the heart. The conditions which have been observed admit of easy explanation through the effect on the surface vessels. When the outside pressure is removed the surface vessels dilate of necessity, and the heart propels the blood with greater ease. The effect is similar in kind, though not in degree, to that of placing a patient

in a hot bath, where all the surface vessels are dilated. This is one of the most efficacious means of treating an excited dilated heart. We may get some light upon this subject by considering what happens in the opposite condition in arterio-capillary fibrosis. Here great work is thrown upon the heart and it becomes hypertrophied, as we see also in cases of chronic Bright's disease. I may say that I have used the cabinet for two years and have not seen any accident or even any unpleasant effect from its use, but I should scarcely go so far as to put into it a patient with advanced cardiac disease, which is more rationally treated by direct appeal to the structure of the heart. The pneumatic cabinet may fail to do good in certain cases, but I am sure it can do no harm.

Dr. Donaldson, Jr., said: There has been a great deal of discussion with reference to the difference between the pneumatic cabinet, and taking the person to a high altitude. The experiments from which these deductions are drawn were performed by placing the animals in the cabinet and rarefying the air, and then permitting them to breathe the air which surrounded them; and the pulse tracing was taken as usual. Our animals were in precisely the same conditions as are persons in high altitudes—so that we were perfectly justified in drawing conclusions from one to the other.

SOME HOSPITAL CASES OF PHTHISIS: MARKED IMPROVEMENT UNDER GENERAL TREATMENT, WITH SPECIAL REFERENCE TO ALIMENTATION.

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OF BOSTON;

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Two years ago I read before this Association a paper on "The Home Treatment of Phthisis," trying to set forth briefly the main principles which should, in my opinion, guide us in the endeavor to cope with this disease. Change of climate was, of course, not discussed in that paper; but such change is in most cases auxiliary to, rather than exclusive of, other treatment. It is my purpose now to supplement my former paper by a few remarks on the general management of phthisis, with special reference to feeding, and to report a short series of hospital cases illustrative of the results which may be gained under conditions partly favorable, partly unfavorable.

These conditions require a little explanation:

For a number of years I have had a six months service every year, with a daily visit, in an institution for chronic cases, containing eighteen beds for adults—the House of the Good Samaritan. About half of the cases are of phthisis, but few of them in the early stages. Many of the patients come to us from homes where they have either unsuitable or insufficient food, poor air, and excessive work or anxiety. In all these respects they are much better off with us, the House having sources of income which permit the use of milk, eggs, and the like, in whatever quantities are considered desirable by the physicians. On the other hand, there are depressing influences in the association of considerable numbers of chronic cases, under the constraint of certain rules, which must, of course, be made and observed. Moreover, there being no garden connected with the institution, it is difficult to secure exercise for those patients whose powers in this direction are very limited. Another difficulty inherent in the treatment of chronic diseases in hos-

pitals, is the lack of occupation and mental stimulus to recovery. It is too easy for patients to dwell upon their troubles and symptoms, and those in charge have to exercise constant watchfulness against exciting jealousies by a real or fancied show of partiality. In short, life in an institution for chronic disease is in many respects an unnatural one, and labors under the disadvantages therein involved, Home life with a less degree of physical comfort is, therefore, often preferable to a prolonged stay in a hospital. Indeed, how often does convalescence from acute disease cease to progress beyond a certain point in hospitals and immediately make rapid and renewed strides on the removal of the patient to other and more stimulating surroundings. I have ventured to dwell somewhat on this aspect of the treatment of chronic disease, because I think that while we, as physicians, realize it perfectly, we sometimes forget it, especially with reference to our hospital patients suffering from a malady which is so common and usually so devoid of diagnostic interest as phthisis.

Of late years I have used the scales more or less systematically with my patients, beginning the practice for my own information and satisfaction, but finding that it has a decided therapeutic value. Especially in hospital cases the knowledge that there is a gain in weight, however small, is stimulating, aids nutrition, and begets further gain. It is my habit to have the weights taken and recorded once a week, provided that the patients are not progressively losing, in which event, on some pretext or other, they are put off. Just as a gain is encouraging, so is a loss discouraging. Those who gain look forward from one weighing day to another, are more likely to take nourishment, and digest it better when taken.

For many years a specific treatment for phthisis has been sought. Since the doctrine of the infectious nature of the disease was first announced, and especially since Koch's discovery of the bacillus tuberculosis, efforts in this direction have been redoubled. If the disease is parasitic, it is rational to think that the destruction of the cause may be followed by the removal of the effects. Most parasitic affections of the skin yield promptly to suitable treatment, even if they are of long standing, and the secondary effects often pass away entirely with time. We now believe lupus vulgaris to be tuberculosis of the skin, and we know that the favorable effects of caustics in this disease is due to their parasiticide action. The anatomical structure and physiological uses of the lungs are, however, such that the problem of the destruction of the bacillus without seriously impairing the lung tissue or interfering with its necessary and continuous function, is a most difficult one. Nor

is this all; there probably are few, if any, individuals inhabiting centres of population to whose lungs the bacilli do not at one time or another, if not repeatedly, gain access. The fact that only a fraction of those who are exposed become tuberculous, forces us to suppose that there is such a thing as a predisposition to tuberculous disease; that certain soils are favorable, certain others unfavorable, to the growth of the bacilli. We know that this is the case with plants; but it is one thing to distinguish earths, and another to distinguish lungs and living tissues in different individuals.

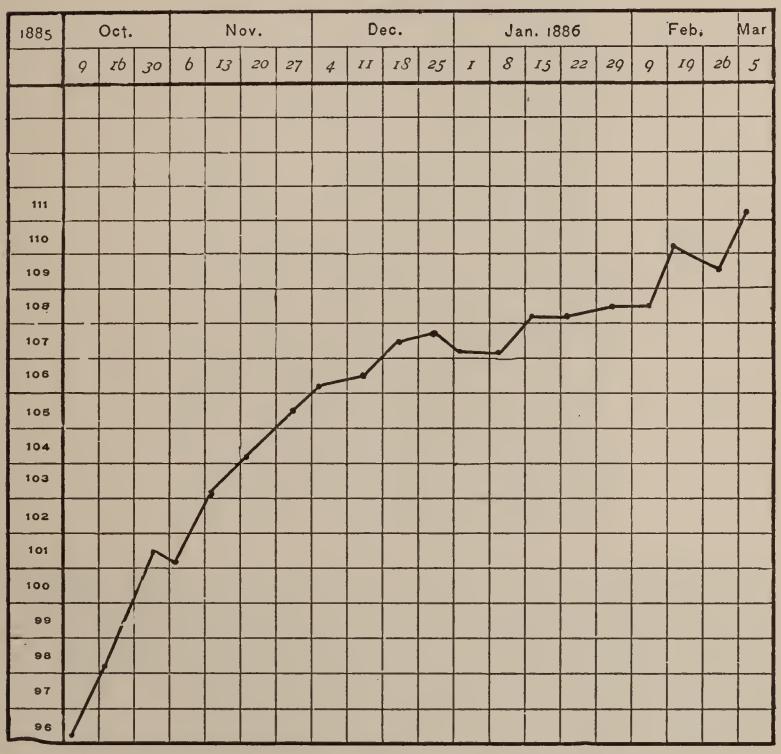
Whatever the future may have in store for us, it is certain that we have not yet discovered any remedial agents, the introduction of which into the system in the form of vapor or spray through the air-passages, in the form of gas through the rectum, injected into the lung through the chest wall, or swallowed into the stomach, can be said to exert any marked specific action on the tubercular process. These observations are all true enough, but are still worthy of constant repetition; lest, under the conviction that tuberculosis is a specific disease, and enthusiastic in the pursuit of a specific remedy, we forget for a moment that the treatment indicated by present knowledge is a general one, directed toward improving nutrition in every possible way. I would not be understood as trying to discourage the search after a specific treatment; some of the methods which have been introduced with this end in view are probably useful as adjuvants if useless alone.

The treatment in this brief series of cases which is appended below, was merely symptomatic and general, except that Case VII. had rectal enemata of gas for a time, during which she lost weight and had discomforts apparently due to this special treatment, which was consequently omitted. Excessive cough and night-sweats were checked if present; the digestion received careful attention; the ventilation of the wards is constantly watched, and an open fire is kept burning in each. Bitter tonics, cod-liver oil, malt, and the like were given in accordance with the varying peculiarities of each case from time to time. Those patients who could go out to walk were encouraged to do so, but care was taken that there should be no over-fatigue. No food was introduced into the stomach artificially; but as much was given as the patient could take in the natural way, and it was given six or seven times a day. Anywhere from two to ten raw eggs, generally beaten up in milk, were given daily to each patient.

Case I.—Mrs. R., æt. thirty-two years, married, of good family history, was admitted September 18, 1885. Three years previously she had a profuse hemorrhage and since then cough with expectoration and other pulmonary

symptoms has been persistent. Her usual weight is 120 pounds, present weight 95 pounds. The physical signs indicated infiltration and softening of the whole left lung, more advanced in the upper lobe. Improvement was nearly steady. Night sweats disappeared, cough and expectoration diminished partly, the moist signs in the lung became much dryer, and March 6, 1886, five and a half months after entrance, she was discharged weighing 111 pounds, a gain of 16 pounds.

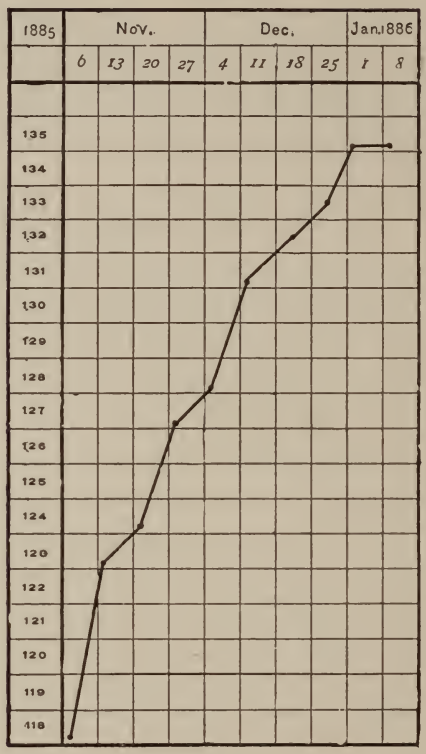
CASE I.



January 24, 1887, she writes, "I don't weigh as much as when I left the Good Samaritan, but I feel very much stronger and can walk a mile without fatigue." It should be noted that this patient was before entrance and has been since in fairly comfortable circumstances.

CASE II.—Mrs. K., æt. thirty-eight years, was admitted November 7, 1885. Her father died of phthisis, her husband of "consumption of the bowels" in October, 1884. Cough began about the time of her husband's death and has persisted. Has had one attack of hæmoptysis, and her expectoration has been bloody from time to time. Amenorrhœa for a year. Weight 118 pounds. There were dulness, broncho-vesicular respiration, and abundant

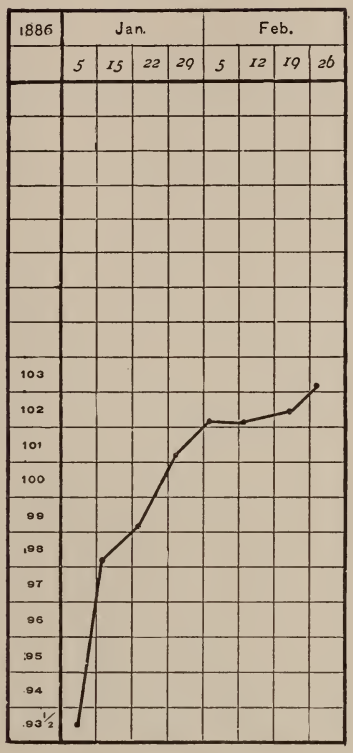
CASE II.



moist râles over the left upper lobe; the sputum contained large numbers of bacilli. Under symptomatic treatment improvement was rapid, steady, and marked. Cough and expectoration diminished, the râles became scanty and dry, and January 12, 1886, she was discharged, weighing 135 pounds, a gain of 16 pounds in less than ten weeks. I have not been able to get track of her since.

CASE III.—M. F., æt. twenty years, a nursery maid, was admitted January 5, 1886. Her family history was good. About a year previous to entrance she took cold and has had cough and expectoration ever since with the exception of two short intervals. No hæmoptysis. Amenorrhœa for four months. Her normal weight was 125, present weight 93½ pounds. The disease had involved the right upper lobe, which contained a good sized cavity. The sputum contained large numbers of bacilli. Under treatment improvement was marked and progressive. The moist sounds gave place to dry and March 5th she was discharged, having gained 10 pounds in weight in two months.

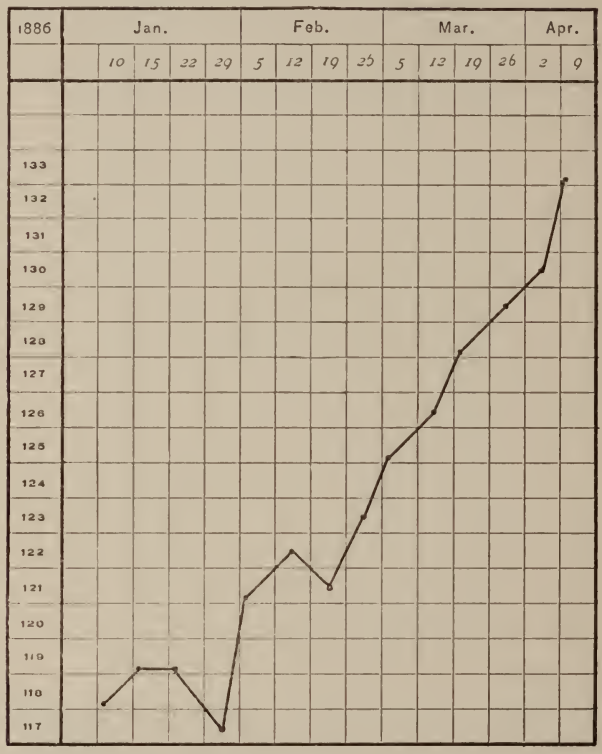
CASE III.



CASE IV.—Mrs. T., æt. thirty-four years, the mother of eight children, was admitted January 8, 1886. The family history was good, as was her previous health up to two and a half years ago, when she began to cough and expectorate. These symptoms persisted for four months, when she was confined. The baby was never well, "fell into consumption," and died at two years of age. She was confined again in February, 1885, and got up well, but cough and expectoration returned in May, between which time and entrance to the hospital she had five attacks of moderate hæmoptysis. She had lost flesh and strength, and suffered from night-sweats. The physical signs indicated partial consolidation of the upper portion of the right upper lobe, with bronchitis of the lower lobe, and the sputum contained numerous bacilli in active spore formation. At the time of her discharge all evidence of bronchitis had disappeared and the signs at the apex were less distinct and more dry. She was about four months advanced in pregnancy. During the three months she remained at the hospital she gained 15 pounds in weight, part of which must, of course, be credited to gestation.

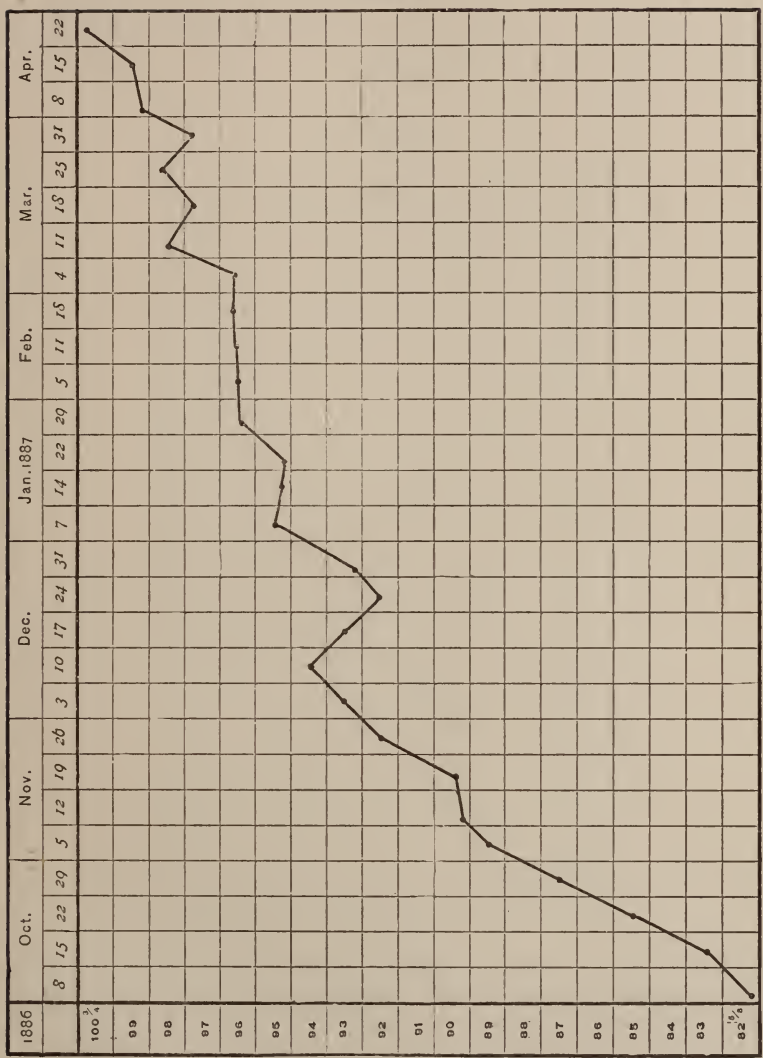
In January, 1887, I learned that she had given birth to her child and was at home caring for her family as usual.

CASE IV.



CASE V.—Mrs. M., æt. twenty-eight years, was admitted October 7, 1886. Her family history was negative, she was the mother of six children, the youngest eight weeks old. Had had cough and expectoration since March, 1885, with loss of flesh and strength; no hæmoptysis. The physical signs showed consolidation of the upper part of the right lung with infiltration of the lower, and extensive bronchitis of the right side. There were a few doubtful signs at the left apex. The sputum contained small numbers of bacilli. The bronchitis of the right side gradually cleared up in a great measure, but the whole lung was more or less involved in the tubercular process. Improvement in strength was slow but steady, and she gained 18½ pounds in weight during the six months of her stay in the hospital. At the time of her discharge, April 16th, the sounds over the right lung were dry, and suspicions were entertained that a cavity had formed at the right top.

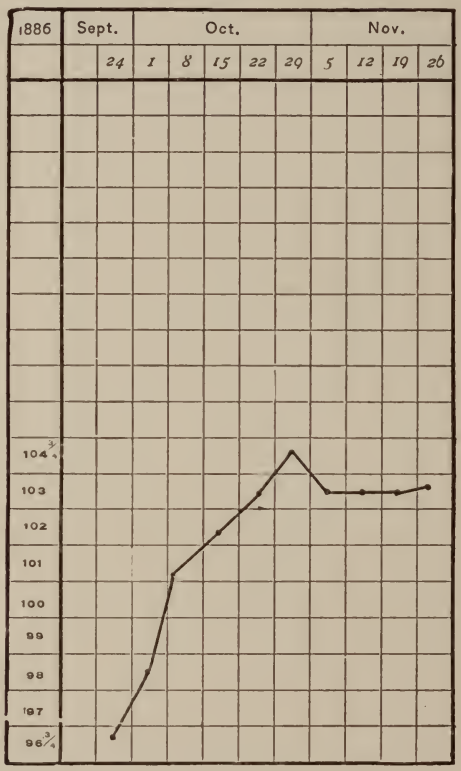
CASE V.



CASE VI.—M., æt. thirty-two years, was admitted September 17, 1886. Her family history was good. At the age of twenty she began to suffer from severe pain in the back; entered the Samaritan four years later and was treated in the surgical ward for angular curvature. Two years and a half ago she began to have a cough which has continued. No hæmoptysis. Loss of flesh and strength, especially of late. Physical examination showed

angular curvature in the lower dorsal region with more or less disease of both lungs. The sputum contained small numbers of bacilli. She was discharged December 4th, having gained in every respect; the increase in weight was nearly 7 pounds in ten weeks.

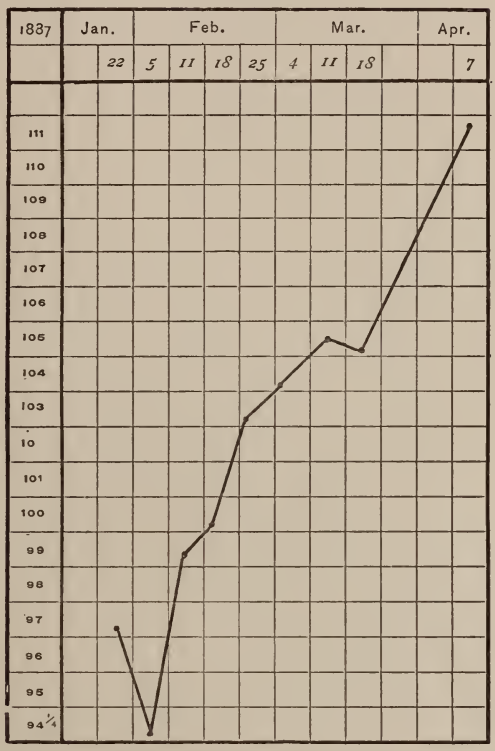
CASE VI.



CASE VII.—H., æt. eighteen years, a domestic, was admitted January 22, 1887. Her father died of phthisis. Suppurating glands in neck in childhood. In September, 1886, she "caught cold" and has had cough with expectoration, once containing some blood, ever since. Marked loss of strength; amenorrhœa. The physical signs showed disease of the right upper lobe, with cavity formation near the posterior aspect. The sputum contained large numbers of bacilli. Although she gained decidedly in flesh and strength the disease in the lung seemed to advance; she had no fever. March 21st she was discharged, having gained 7 pounds during her two months in the hospital. About three weeks after her discharge she presented herself again and was found to have gained about six pounds more

in weight, while the physical signs showed further advance. She was however, stronger and felt better.

CASE VII.



CASE VIII.—D., æt. thirty-five years, married, a laundress at the Massachusetts General Hospital, was admitted to the Samaritan, February 7, 1887. In July, 1886, she began to suffer from pain in the back, not felt while lying down but excited by movement and standing. This was the first symptom of an angular curvature in the upper dorsal region, which, with slight pressure symptoms, was sufficiently marked on entrance to the Samaritan. There was also dulness with moist râles, especially after cough, over the upper portion of the right lung. The absence of expectoration precluded an examination of the sputum. The weight on entrance was 106⅛ pounds, is now 117 pounds.

CASE VIII.

Alcoholic stimulants were not administered to a single one of these patients except here and there for a few days at a time in the form of a compound tincture of cinchona or gentian, a drachm before meals. Within the past few years I have been steadily cutting down the amount of alcohol which I prescribe in chronic cases and have seen no reason to regret the course. In chronic, and especially perhaps in hospital cases, there is a real danger of the establishment of bad habits as regards this agent, which, I am convinced, moreover, entirely apart from moral considerations, is not a necessary part of the treatment of phthisis. There are cases in which it is required, sometimes for a longer, sometimes for a shorter time, but my experience has satisfied me that it is often used without sufficient discrimination in this class of diseases. Beef, milk, eggs, and other nourishing foods are more expensive; but if they can be secured and assimilated in sufficient quantities it is my belief that it is wiser to let alcohol alone, or use it

in limited quantities and at stated times like any other drug. In the year 1883 the average amount per patient expended during the year for alcoholics, including beer, was $2.70; in 1886, $0.34. The patients received no injury even if they derived no advantage from this reduction.

EDWARD T. BRUEN, M.D.,

OF PHILADELPHIA.

Mr. President and Members of the Society: Dr. Shattuck has well said that the treatment of the early and later stages of phthisis consists in overcoming any inherited and predisposing cause which favors the production of consumption, and also during the progress of the disease the use of certain medicinal agents to control certain symptoms which arise. The more important therapeutic measures at the command of the physician are, diet, climate, and suitable hygiene. It is possible, by means of certain dietetic and climatic measures, so to change the nature of the tissues, that they shall not be suitable culture media for the reproduction of the bacillus of tuberculosis.

I arise in discussing this paper, chiefly to bring before you the use of the Bergeon method as a useful addition to our therapeutic armamentarium. This treatment consists in the injection of a certain amount of sulphuretted hydrogen gas propelled into the system by carbonic acid gas. So far as its power in antagonizing the specific element of phthisis, the Bergeon method, in my experience, has been a failure. I have had under continuous observation, since February last, some sixty cases of phthisis in different stages of the disease. In each case from three to five examinations of the sputa have been systematically made. These examinations have been conducted by Dr. E. O. Shakespeare, my colleague at the Philadelphia Hospital, and were made without a knowledge of the clinical progress of the case. Without exception, the bacilli have not been influenced in the least as regards their number, or their behavior toward the staining solution. Bergeon has claimed, I believe, that his treatment is not so much antagonistic to the specific germs of tuberculosis as it is antagonistic to certain of the symptoms produced by catarrhal inflammation, which complicate phthisis in its different stages. He also claims that it antagonizes the septicæmia caused by the absorption of the catarrhal elements formed in the progress of the disease.

The method of Bergeon should be classed as a valuable medicinal

agent in the treatment of this terrible disease. The good effects which have been produced in my hands, are a reduction in the temperature, very commonly in a decided manner, and a material diminution in the quantity of expectoration, very often the treatment has completely suppressed all bronchial catarrh, thus reducing expectoration to a minimum. In this way it reduces the cough, improves the appetite, and enables one to conduct a dietetic treatment with greater satisfaction.

In making a brief summary of the sixty-one cases I have had under observation, I may say that forty-four showed different degrees of improvement. This was marked in some by a fall of temperature to a normal point, by the reduction of expectoration to a small quantity, and by a gain in weight of from five to ten pounds. In a number of the cases, perhaps one-half, the temperature has been reduced two or three degrees. I believe that in all my cases which have been benefited the disease was continued in a latent state. Some of the cases have, from time to time, suffered from outbreaks of high temperature, outbreaks of bronchial catarrh, and outbreaks of cough and expectoration. These have again subsided under a reapplication of the treatment.

I have had fifteen cases in which an entirely negative effect has followed the treatment. I cannot say that they were influenced favorable or unfavorably. In no case have I used the gas with any injurious results.

The cases in which I have obtained the most benefit, have been cases of rather advanced phthisis, in which there was a considerable catarrhal element. In those cases in which there has been more or less thickening of the lung, with the general symptoms of phthisis well marked, with wasting and loss of weight, without much expectoration, without much rise of temperature, the treatment has not been followed by any marked good effect.

Two of the patients in whose cases I employed the Bergeon treatment have since died, and I have had an autopsy in one case. In this instance, although the cavities in the lung seemed unusually clear and free from pus, yet I do not think that any tendency to cicatrization could be observed.

I have not found strong solutions of the gas at all satisfactory. I have had the best results from the use of a solution of five grains of sulphide of sodium with five grains of chloride of sodium in one and one-half pints of water. I have always used this solution before trying others. In some of the cases where negative results were obtained from the use of this solution, I have not succeeded in any series

of cases in obtaining better results by increasing the strength of the solution. On the other hand, some patients have experienced pain even with the five grain solution. In these I have found it advantageous to use a weaker solution. The water of Sharon Springs, New York, I found especially satisfactory and have used it with the addition of five grains of the sulphide of sodium to the pint of water.

As to the amount of gas used, my experience goes to show that there are certain persons whose intestines are not susceptible to the irritant effect of the gas, while in others the sensitiveness is considerable. In this latter class I have accomplished a good deal of good by using only one pint of gas every day for a week, then twice a day for a week, and then increasing it rather rapidly. I have never found it desirable to give more than a gallon and a half, and usually limit the quantity to four quarts.

The mode of administration is also a matter of some importance. It seems to me desirable to give the gas extremely slowly, and this necessitates the consumption of a large amount of time. The injection cannot be given in less than thirty to forty-five minutes. In most cases I have employed the gas twice daily, but a single injection in each twenty-four hours will be productive of some benefit when the more frequent use of the gas causes intestinal irritation.

As to the influence of the treatment in producing diarrhœa, I have never been successful in using the gas in cases in which there has been diarrhœa or any tendency thereto. Indeed, I think that in some cases diarrhœa was induced by the treatment.

I feel, in making this brief statement, that I have undervalued rather than overvalued this important therapeutic measure. It seems to me that in the treatment of the class of cases in which I have said that the use of the gas was beneficial, I have not had as much comfort from any other plan of treatment. I should not, however, think of placing this gaseous treatment of phthisis in the scale against the climatic treatment of the disease, but there are many patients who have not the means of going abroad. In these cases, by diet, by hygiene, and by the use of the gas, I think that we may be able to accomplish more than we could before this plan of treatment was brought to our notice.

The favorable success in most cases of this plan of treatment should stimulate us to study more carefully the antiseptic methods of treatment, especially the use of such vapors as are produced by the Evans vaporizer. Carbolic acid and iodine with glycerine, and water or terebene with eucalyptol, have been the drugs which produced the most satisfactory results. With these local remedies an internal

treatment by iodoform, arsenic, and iron, is very useful. In some cases creasote may be given advantageously several times daily in milk in addition to the foregoing measures.

DISCUSSION.

Dr. B. F. Westbrook, of Brooklyn, said: I would ask Dr. Bruen whether, in the cases in which he has used the gaseous enemata, he has ever noticed the sulphurous odor in the breath while the gas was being administered, or soon after it.

I did not exactly catch the speaker's meaning when he spoke of using a "pint of gas" and a "gallon of gas." I suppose he referred to the carbon dioxide. I have found it difficult to determine the exact amount of hydrogen sulphide which I have been using, and I know of no method of ascertaining this.

Dr. Bruen said: I am glad that Dr. Westbrook has reminded me of the point with reference to the breath. I have always tested the breath for the reaction of the sulphide of hydrogen, but I have had a negative result in at least eight out of every ten cases. The test was made by holding over the mouth, while the gas was being administered, a piece of filtering paper saturated with a solution of the acetate of lead. There has, in some cases, been a faint blackening, but nothing like the blackening which occurs when the test-paper is held in the stream of gas escaping from the bottle. This goes to show that the good effect must be produced by very small quantities of gas, and is another argument for the use of a weak solution of the gas.

With reference to the expression a "gallon of gas," I alluded to the carbon dioxide which passes through the wash-bottle. Some of my friends have told me that they have used sulphuretted hydrogen prepared and mixed with the carbon dioxide. I have not used this, however, relying entirely on the wash-bottle.

Dr. S. Solis Cohen said: I have been much interested in the remarks of Dr. Bruen, but as the experience of Dr. J. Solis Cohen and myself has been somewhat different, I should like to state the points of difference. Contrary to the experience of Dr. Bruen, we have seemed to obtain the most decided benefit from a strongly impregnated water. At first we used the Red Sulphur Springs water, but with this we failed to get reaction on testing with plumbic acetate in a large proportion of cases. The Mount Clemens water was then used with better result; frequently, however, it was necessary to add sodium sulphide or potassium sulphate. Lately I have resorted, with apparently good results, to the use of a solution recommended by a

French observer, who adds to 200 grammes of water 10 cubic centimetres each of the following solutions:

1.	Sodium sulphide	10 grammes.
	Distilled water	100 cubic centimetres.
2.	Tartaric acid	25 grammes.
	Salicylic acid	1 gramme.
	Distilled water	100 cubic centimetres.

This liberates a certain definite quantity of sulphuretted hydrogen, sufficient to cause the reaction with plumbic acetate. The best therapeutic results have been obtained in those cases in which this reaction has been obtained; and of these the most satisfactory effects have seemed to be in cases in which there has been the taste of sulphuretted hydrogen in the mouth, and where this has persisted for an hour or more after the use of the injection.

The treatment has not been in our hands long enough to say what it will accomplish in the way of cure. At least a period of four years is required to settle this question. Observation should be directed to the class of cases most likely to benefit from it. The cases treated have included cases of incipient phthisis, and also those in which there were large cavities. I believe that it will be found unnecessary in the first group, and useless in the second. The best results have been obtained in those cases where softening was about to take place, or where suppuration had begun but not progressed far enough to cause destruction of so much lung tissue as to make the case hopeless. Bergeon states that the treatment is directed against the suppurative process and not against the bacillus or any other agent concerned in the production of the disease. That the treatment by sulphuretted hydrogen or other medication must be secondary to nutrition, as Dr. Shattuck has pointed out, all will agree. I have seen good results from forced feeding, and I have seen equally good results from feeding with condensed forms of aliment, without the tubes, in connection with the inhalation of compressed air, and the use of measures to restore, as far as possible, the integrity of the digestive tract. In order to get benefit from the sulphuretted hydrogen method of treatment, attention must be paid to all the details, especially with reference to the time consumed in the administration of the injection, the exclusion of air from the apparatus and intestine, and the warming of the gas to be injected. There is no reason why appropriate measures in addition should not be used in connection with it.

Dr. H. F. Williams, of Brooklyn, said: I have been searching for an explanation of the effects which it is asserted are gained by the use of the gaseous enemata. I have reached some conclusions which were strengthened by a remark made before the New York Academy of Medicine by Dr. Kinnicutt, when reporting the results in some of his cases. He had come to the conclusion that the good done was entirely due to the carbonic acid.

This so strengthened the little theory that I have on the subject that I venture to mention it, although fully conscious that it is imperfect. Gaseous absorption is not a new thing in nature, if it is in practice. I do not think it possible to deny the fact that where a person evolves gas and does not pass it per vias naturalis, it must be absorbed. We have only to remember the bad odor of the breath and the pallor of the skin in these cases to be convinced of this. It is undoubtedly true that this process has been going on from time immemorial. Physiologists have told us that in the carbonization of the blood, carbon dioxide is taken from the waste tissue, and that this is largely influenced by temperature and exercise. It seems to me that in the administration of carbonic acid, which is thrown into the rectum and enters the portal circulation, and reaches the venous side of the heart, the lungs furnish an impassable barrier to the reabsorption of the gas into the arterial system. More carbonic acid is thrown off because we put it into the venous circulation. It is a law depending on the atomic weights of oxygen and carbonic acid gas that if more gas is given off, there is more room for oxygen; consequently, it is possible that we are really giving oxygen where we are giving carbonic acid. It is possible that some such explanation as this is the correct one, and that we are furnishing the patient with more oxygen than he would otherwise get, by creating a place for it by producing increased gaseous dialysis.

I was struck with one remark of Dr. Shattuck, and that was that when patients were losing weight he tried to keep the knowledge of that fact from them. I have tried by all manner of subterfuges to keep from patients the knowledge of their weight, for this is a two-edged sword. If there is a gain, it is all right; but if there is a loss of half a pound, they will soon lose another half pound.

Dr. Bruen, of Philadelphia, said: It is of considerable importance to ascertain the question of percentage of good results in these cases. I would ask Dr. Cohen, what were the best results in the cases to which he has referred, and the percentage in which benefit followed the treatment?

Dr. S. S. Cohen, of Philadelphia, said: I have no statistics with me. I have already said that we are not justified in talking about cure in less than four years. What I term the best results are a rapid increase in weight; for instance, in three cases which I recall at the present moment as having come under treatment within the past month, there has been in one case a gain of three pounds, in another of five pounds, and in another of two and one-half pounds in the course of a few weeks: a diminution in temperature, as, for example, in a case which came under treatment two weeks ago with a morning temperature of 101.5°, and this morning had a temperature of 99°—a diminution in the cough, promotion of sleep, and similar relief to symptoms. With reference to the bacilli, I have made no examination, for I recognize the fact that the treatment has nothing to do with bacilli. If Dr. Bruen particularly desires percentages, and will accept rough estimates from general impressions, I should say that in about fifty per cent. the symptoms have been greatly ameliorated; that in twenty-five per cent. they have been

slightly ameliorated, while in the remaining twenty-five per cent. there has been more or less benefit to some of the symptoms. I have myself seen no case in which no benefit whatever has followed, although I understand that there have been recently some cases at the German Hospital in which the results have been negative. As before suggested, the stage of the disease may have much to do with this.

Dr. P. H. Kretzschmar, of Brooklyn, said: I am somewhat in the position of Dr. Shattuck, having charge of a hospital in which chronic cases are treated. About twenty out of the forty beds are occupied by cases of consumption. I was much interested in hearing the remarkable results which Dr. Shattuck reported, but I should like to know what was the whole number of patients from whom these benefited cases were obtained.

Dr. James T. Whittaker, of Cincinnati, said: What I have to say is, I am afraid, rather premature for this audience. For the past month I have been using the sulphuretted gas by inhalation. Previous to that time I had used it by injection. I get about the same results by inhalation as by injection.

It seems to me that our greatest advance is made possible by abolishing the idea of heredity, which has been so great a bar to our progress. We owe much to our President for taking a bold stand against this dogma, or, at least, for showing that the influence is never directly transmitted, and that there is no fœtal tuberculosis. The whole question hinges on the possible transmission of some defect of structure, that is, of soil and not of seed. This does not render the subject more liable to phthisis than to pneumonia, or any other disease. We must heartily welcome any measure that will favor the home treatment of phthisis, which is alone possible at present in the great majority of patients.

My experience has not been so great as that of the gentlemen who have preceded me. I have treated about fifteen cases in private, and about the same number in hospital practice. After using the rectal method for a month, I commenced the use of inhalation; at first tentatively, and then more and more boldly. I now put my patients in the pneumatic cabinet and give them all the gas that develops. I have seen no unpleasant effects whatever. With the rectal method of administering the gas, a few patients complained that they could not retain the gas, but the use of a longer tube or a longer time overcame this difficulty. I have never been able to use more than a gallon of the carbonic acid gas, because this amount produces a full distention of the abdomen. From the inhalations in the pneumatic cabinet I get the same results in the reduction of temperature, relief of cough, and prevention of night-sweats, as from the enemata. In about one-third of the cases there were no results, but in no case was any harm done. I have looked over the literature to see what damage has been done by the use of sulphuretted hydrogen, and I have been able to find but two cases in which bad results followed. In these cases the gas was evolved in great amounts, and was consumed almost to the exclusion of atmospheric air.

I am entirely incredulous concerning the statement that carbonic acid pro-

duces the good effects. Carbonic acid is continuously present in the lungs, and yet it has produced no good effects. The good is done by the sulphur. From time immemorial, the beneficial results of sulphur have been known. In the Pyrenees and in France there are places where patients breathe sulphuretted hydrogen gas. The old writers spoke of sulphur as the balsamum pulmonum. I have no reasons to offer to account for its good effect. It does not destroy the bacilli. I think that all bacteriologists admit we have as yet no agent that will destroy these microörganisms, and not prove destructive to the tissues. It is probable that this agent addresses itself to the soil and renders it unsuitable for the growth of the bacillus, whereby it may bring about the conditions which nature effects at times in cases of spontaneous cure by methods which are as mortifying to the physician as they are mysterious.

Dr. Roland G. Curtin, of Philadelphia, said: Dr. H. C. Wood, of Philadelphia, has recommended the administration by the stomach of water saturated with sulphuretted hydrogen gas. The dose of this sulphuretted hydrogen water is half an ounce three times a day, passing carbonic acid water through the dose from a siphon bottle at the time of administration. I have used this in four cases with the same result as when injected into the bowel, viz., an improvement in the constitutional symptoms and diminished expectoration.

Dr. J. B. Walker, of Philadelphia, said: I have used the gaseous enemata in the Philadelphia Hospital, employing the same method used by Dr. Bruen, but my results have not been so marked. I have treated in all about thirty cases. My best results have been obtained in two cases. One was a case of incipient phthisis with marked consolidation at the right apex. The patient was a man of five feet ten inches high, who, on admission to hospital on April 28th, weighed 146 pounds. On May 25th he weighed 160 pounds, a gain of fourteen pounds in four weeks. This patient had had the benefit of the treatment described by Dr. Shattuck before the gas was administered, and I am satisfied that in his case the gas was of benefit.

The second case was that of a woman carried into the wards of the hospital four weeks ago. During these four weeks she has gained eight pounds in weight, and is now an assistant in the ward and able to do her daily work.

The majority of my cases have not done so well as the cases of Dr. Bruen, chiefly, I think, because my resident was opposed to the use of the gas, while Dr. Bruen's resident was quite enthusiastic. More depends upon the proper administration than upon the strength of the solution. Much pain is induced in some cases due to too rapid introduction, to admixture with atmospheric air, or to using the solution of the sulphide cold. In all the cases the patients have slept better, there has been less expectoration, less cough, and the expectoration has not been so purulent. The appetite and digestion have also been improved. I am satisfied that this adds one means to our armamentarium for treating phthisis.

Dr. F. C. Shattuck, of Boston, said: In reply to the question of Dr. Kretzschmar, I would state that the cases which I have reported were selected from some fifty or sixty. Many of the patients have died, and others have not improved. I simply brought these forward as illustrations of what may sometimes be done with care.

I should like to say a word or two with reference to the gas treatment, for my experience has not been so encouraging as that of the gentlemen who have spoken. I began the use of the gas about the middle of January. I had an apparatus made, and as I could not obtain a natural sulphur water I prepared an artificial water. My results did not encourage me to continue the treatment. Dr. Westbrook asked how much of the sulphuretted gas passed into the bowel. The water of Eaux Bonnes was recommended in the original prescription of Bergeon. One-half a litre of this has a capacity for three cubic centimetres of sulphuretted hydrogen. Even supposing that the patient gets the whole of this, he does not get much. Bergeon reports very good results from that quantity. I used a nearly saturated aqueous solution of the gas, and got collapse in varying degrees with great prostration, pallor, weak pulse, vomiting, nausea, and headache. This occurred in several cases. In other cases the treatment was pretty well tolerated, but did no good.

Dr. Bruen's solution is many times stronger than that of Bergeon. Dr. Cohen seems to think that even this is not strong enough. In one case of asthma with chronic bronchitis and emphysema, the patient had thirty-four administrations of the gas. It did not cause any disturbance even when a strong solution was employed, but it did not do any good. In a previous attack, the patient under the use of iodide of potassium, linseed oil, and so on, which were also given during the second attack, did just as well as when the gas was administered.

OBSERVATIONS ON THE SANITARY ADVANTAGES OF TIDE-WATER VIRGINIA, EMBRACING VIRGINIA BEACH, AS A WINTER HEALTH RESORT.

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In selecting a subject worthy the attention and consideration of this Association, it might very naturally be expected that the author would confine himself within the domain of climatology, a field so ample in its proportions when contemplated from a scientific and medical standpoint as to challenge all the zeal, labor, and study that we can command for the elucidation of those hidden and unexplored capacities which relate directly to the conditions of human health.

Recognizing the appositeness of this proposition, I have chosen as the subject of this paper, observations upon the sanitary advantages of tide-water Virginia, embracing Virginia Beach, as a winter health resort.

The very fact that the selection has been made of a portion of our country included among the earliest settlements of this continent, demonstrates, at once, how little attention has yet been bestowed upon the subject of climatic influences upon health, in the vast domain of this country, emphasized by the fact that even at this late day with all the appliances and progress of science, added to the extraordinary facilities for obtaining knowledge, we have to rely in a large degree, upon tradition for facts that have a direct and important bearing upon practical sanitation in many populous and long settled regions of the older States.

In so brief a paper as I shall present, it is not my purpose to enter upon an extended analytical discussion of the several factors which may be embraced in the consideration of a health resort, but confine my remarks only to those which go to make up the sum of what is understood by the general term, climate; including topography, soil, humidity, wind, and temperature. For, at least, a century the tradi-

tional belief has prevailed among the inhabitants of tide-water Virginia, embracing the counties of Elizabeth City, York, James City, Warwick, west of the Chesapeake Bay, and the two counties of Accomac and Northampton on the eastern shore of the Bay, that pulmonary consumption was a rare disease—in many of them almost unknown.

It is deeply to be regretted that no systematized record of diseases has ever been kept in these localities down to the present time, thus compelling us to accept such fragmentary information as can be gathered through the uncertain channels of tradition; nevertheless, the observations of intelligent physicians residing within this region during later years go to confirm this popular belief. The whole of this region of country is composed chiefly of a light, sandy soil, at one time almost entirely overspread by extensive pine forest, and, although interspersed by rivers and creeks, whose shores are in many places lined by marshes, the cultivated lands and forests are remarkably dry and porous. These bodies of pine forests, besides affording protection from the cold winds of Winter and Spring, furnish a constant source of terebinthinate exhalations, which can be readily perceived at all seasons of the year, but especially so during the Summer and Spring. With the exception of intermittent fevers, which prevail to some extent along the borders of the streams, this whole region is remarkably exempt from disease. It has been a subject of common observation for many years, that persons affected with pulmonary consumption, when brought to the piney regions of this section and permitted to reside there for a long period, almost invariably improve in health and in many instances get apparently well. In view of the popular theory of the present day, one, indeed, almost universally accepted, that certain altitudes constitute one of the most important and efficient agents in the climatic treatment of this disease, these statements may seem somewhat startling and improbable.

In support, however, of their correctness I have been able to obtain a few statistical facts bearing directly upon this point. These facts show that in the following named counties and the city of Williamsburg, which embrace all territory between the James and York rivers, and from this point to the ocean, including the counties of Accomac and Northampton on the eastern shore of the Chesapeake Bay, the deaths for the years 1881, 1882, 1883, and 1884 were as follows (the list is given with the population of each, as reported in the United States census of 1880):

ACCOMAC.

Population, white	11,841
" colored	12,567
Total	24,408
Deaths in 1881	287
" 1882	256
" 1883	186
" 1884	389
Total	1118

NORTHAMPTON.

Population, white	3389
" colored	5763
Total	9152
Deaths in 1881	117
" 1882	117
" 1883	48
" 1884	45
Total	327

ELIZABETH CITY.

Population, white	4158
" colored	6531
Total	10,689
Deaths in 1881	95
" 1882	122
" 1883	134
" 1884	105
Total	456

YORK.

Population, white	2837
" colored	4512
Total	7349
Deaths in 1881	58
" 1882	83
" 1883	80
" 1884	13
Total	234

JAMES CITY.

Population, white	2227
" colored	3197
Total	5424
Deaths in 1881	41
" 1882	41
" 1883	50
" 1884	51
Total	183

WILLIAMSBURG.

Population, white	740
" colored	740
Total	1480
Deaths in 1881	19
" 1882	19
" 1883	17
" 1884	14
Total	69

Thus, we see in these five counties and one small town, aggregating in 1880 a population of 59,300, the average death-rate for the four years above given was, for each, as follows; fractions omitted:

Accomac	274, or 11 to 1000
Northampton	81, or 9 to 1000
Elizabeth City	114, or 11 to 1000
York	88, or 12 to 1000
James City	45, or 9 to 1000
Williamsburg	19, or 12 to 1000

We have an average of deaths in the above counties and towns, from all causes, of about 10.68 to 1000 of population.

The colored population in these counties exceeds the white by 9.818. In the United States Census of 1880, Virginia is divided into three grand groups (See vol. xi., Part 1, *Vital Statistics*), so as to show the percentage of deaths to the 1000 each. These groups are designated Nos. 1, 2, and 3. The first embraces twenty-seven counties on the "Middle Atlantic Coast" with a white population of 136,715, and a colored population of 166,077; total, 302,792.

The second, thirty-seven counties, called "Interior Plateaus and Table Lands," with a white population of 323,541, and a colored population of 340,709; total, 664,250.

The third, called "South Central Mountainous," contains a white population of 420,693; colored, 124,830. Total, 545,523.

The death-rate in these groups is as follows, per 1000:

	White.	Colored.
First group	18.12.	17.47.
Second group	15.27.	20.80.
Third group	11.71.	18.77.

In the eastern, or first of the groups, the colored population exceeds the white by 29,362; in the second, the colored exceeds the white by 17,168; in the third, the white exceeds the colored by 395,863. The average death-rate in the State is for whites 15.05, for colored 19.12.

Now on the Peninsula, and including Accomac and Northampton counties, the death-rate for *both races* is but 10.66 per 1000.

If we take the ratio of deaths among whites and colored in the first group of the State (of which these counties form a part), we find the death-rate per 1000 to be for whites 18.12, for colored 17.47. But the death-rate for *both races*, in the counties above named, is but 10.66, or 7.46 per 1000 less than the average death-rate of the whites in the group No. 1, and 4.39 less than the average of the death-rate of whites in the State as a whole.

We have no means of estimating the actual ratio of deaths between the whites and colored on the Peninsula, but may fairly estimate it on the basis it occurs in the first group of the State, of which they form a part. Thus, we see the favorable showing for this section.

That consumption is a rare disease in this region is clearly indicated by the small death-rate from all causes. An intelligent physician, Dr. R. A. Wise, who has resided at Williamsburg for the last seventeen years, writes thus, when speaking of pulmonary consumption:

"I know of many instances in which the disease has been arrested, or rather a strong predisposition to it has been overcome in this section. The College of William and Mary has had an average attendance of students, counting all the time it has been closed, of over thirty pupils for the last 193 years, a total of at least 5790, and not a single death from consumption has occurred among these while at the college. Only eight deaths have taken place among students at the college, from all causes, in the whole period above named, and three of these were from accidental causes. This information is furnished me by Col. Benjamin S. Ewell, the venerable President of the college.

"Williamsburg is particularly exempt from tubercular disease."

The above statistics supplemented by the experience and statement of an intelligent and capable medical gentleman, necessarily command

a thoughtful consideration by the student of climatology as it relates to disease, and challenges speculation and inquiry into the inherent causes or instrumentalities which exercise these sanitary influences claimed for this region of the State of Virginia.

In considering this subject it has occurred to me that, apart from the local and indigenous conditions of temperature, soil, topography, and forests of this section, the proximity of that vast region of pine, cypress, and fir known as the Great Dismal Swamp, should not be overlooked as playing a possibly important part in the solution of these questions.

Lying immediately south of the city of Williamsburg and about fifteen miles distant, the winds, for the greater part of the year, prevailing from that direction, it is more than probable that they come loaded with the exhalations perpetually going on from this immense forest tract, embracing as it does an area of thirty by ten miles.

Accepting the theory which has been latterly advanced that the important atmospheric principle of ozone is in some way associated with, if not a direct product of pine forests, we may reasonably include this agent as a probable factor in estimating the sanitary influences of the Great Dismal Swamp, but as yet our researches in determining the exact origin and nature of this subtile principle have proved too vague and uncertain in their results to justify us in speaking ex cathedra upon this subject.

Notwithstanding the close intelligent study bestowed upon the subject of ozone of late years, questions of doubt are continually arising on the action and influence of this subject in nature, and whether our ozonoscopic and ozonometric observations are sufficiently exact to be of value. The reactions by which we can detect the presence of ozone are sufficiently delicate and distinctive for that purpose, but the means for determining the amount of ozone and of readily estimating the changes of quantity present in the air at one moment, and that present after an interval, are anything but fixed and satisfactory.

We know that the further we remove from the seashore and its influence, the less the amount and presence of ozone is recognizable. If electricity be really the principal cause of the production of ozone, as Décharmes was convinced of, stating that the curves of atmospheric ozone and of progress of atmospheric electricity were nearly parallel, it might then be possible to get observations more exact.

Variations of atmospheric ozone taken near Versailles, show the following results in many localities:

"1. Dividing the day into two periods of twelve hours each—*i. e.*, from 9 P. M. to 9 A. M., and from 9 A. M. to 9 P. M.—the paper exposed during night is most deeply colored.

"2. Dividing the day into four periods of six hours each of exposure, the result has been shown that papers exposed from 9 A. M. to 3 P. M. display more ozonic influence than is apparent on paper exposed between 3 P. M. and 9 P. M., and this difference is more evident as the months are warmer.

"3. Dividing the day into four periods of three hours each, in cold and temperate months, the strongest ozone tint is produced by papers exposed from noon to 3 P. M., in the hotter months by papers exposed from A. M. to noon.

"4. In winter the greatest variation is between 3 A. M. and 3 P. M.

"5. The augmentation of temperature does not increase the production of ozone as does the amount of aqueous vapor to which the ozone appears attached.

"6. Barometric oscillations have no influence on the direct production of ozone, unless the condition of watery vapor be taken into account."

"Ozone may be produced naturally or artificially. Natural modes (three):

"*a.* Electrization of air or of water in storms.

"*b.* By influence of solar light.

"*c.* By decomposition of carbonic acid by growing vegetation."

In the foregoing remarks it will be observed that I have made no reference to the city of Norfolk and the region of country lying east of that city, extending as far as the Atlantic Ocean. Nothwithstanding the presence of numerous small bodies of water scattered throughout this section, the similarity to that already described in topography, climate, soil, and forests renders it equally desirable in a sanitary point for those affected with, or predisposed to, pulmonary consumption. In support of this statement, I here introduce an interesting and elaborate communication addressed to me by Dr. S. J. Jackson, of the city of Norfolk. Dr. Jackson, as you are probably aware, is a close and intelligent observer, and has contributed much scientific and valuable information on kindred subjects to medical literature, which entitles his views to our consideration and respect. He writes:

"For some years before the region around about Norfolk, in Virginia, seems to have been thought of as a place for winter resort for invalids suffering from pulmonary affections, it had been discovered that its climate was mild enough for the raising of early vegetables, and until increased facilities for transportation brought the more southerly district of South Carolina, Georgia, and Florida in competition with it, it furnished the northern market with its chief supply of early spring vegetables. The 'trucking business,' as it is called, has increased tenfold in the last thirty years, viz., from about $200,000 in 1856, to about $2,000,000 in 1886. Besides this evidence of the mildness of the climate, another had been furnished long before by yearly immigration to this region of water-fowl, such as geese, ducks, and swan,

from the cold northern latitude where they spend their summers in hatching and rearing their young. On the beginning of winter, flocks composed of countless myriads of them, pour into the waters of this region, there to remain until the opening of spring. The genus Homo might have learned a lesson long before from the instinct of these birds, but it was not until the war had revealed its charms to soldiers from the North, who had never known such a climate, that this region was ever thought of as a place for winter residence, or as a winter resort for invalids."

"Indeed, up to that period Norfolk had very unfortunately and unreasonably acquired the reputation of being an unhealthy 'place.'

"The disastrous importation of yellow fever in 1855, by which she lost some two thousand of her population, would have ruined her prospects as a place of residence, but for the fact that the disease was known to have been imported, and not to have been generated here; and, further, it was proven that the subsequent winter was cold enough to destroy every vestige of the infection so completely, that it never revived or reappeared, and probably never will, unless through some carelessness or inadvertence of the health authorities, it should be allowed to enter again.

"But the question will naturally occur: Why should Norfolk in a latitude above the northern line of North Carolina and Tennessee have a milder climate than those States, and how is it possible for it to compete with the more southerly States mentioned in the production of spring vegetables, or in furnishing a mild winter habitation for those whose health will not allow them to remain in the northerly latitudes? The explanation is to be found in our proximity, to the *gulf stream*, that great river in the ocean, which, heated in the torrid zone, carries and distributes its warmth along its track, even to that far off northern island 'The Emerald Isle,' which, but for this, would be more like Labrador than the beautiful green spot that it is. Before the gulf stream reaches the coast of Ireland it has traversed thousands of miles of ocean, wasting its heat may be upon icebergs, or at any rate, by encountering the cold currents from the north, until it might be supposed not to have a sufficient amount reserved for its beneficent purpose. But it passes our shore before it has had time to lose its heat, coming direct from the Carribean Sea it has encountered no cold winds or waves before it reaches us. Besides warming the winds, which, sweeping over it, bear to us its balmy sweetness, its eddies actually lave our shore.

"A glance at the map will show how far off from the coast of Georgia and the Carolinas the gulf stream is forced to clear Cape Hatteras; but from that point northwardly it runs more nearly parallel with the shore until, when opposite us, it is only thirty miles distant.

"From the Virginia Capes northward the coast line and gulf stream diverge, the latter tending rapidly to the northeast. But for this divergence the whole Atlantic-American coast would share its general warmth.

"But besides our proximity to this heat-bearing current, there is another most important and valuable circumstance which causes a more general

distribution of its warm water on our shore than would be produced by ordinary eddies. The space between the Virginia Capes (Henry and Charles), only about ten miles, is the waste-gate for an immense body of water borne down to the Chesapeake Bay by the rivers of Maryland, Pennsylvania and Virginia. The Susquehanna, the Patapsco, the Severn, the Rappahannock, Potomac, James and Elizabeth, and their tributaries, which drain the immense water-shed of these great States east of the Appalachian range of mountains, can only empty their torrents through this narrow gate-way. So vast a body of water poured into the ocean through so narrow a vent must be forced very far out into the sea, so far, indeed, as to form no inconsiderable impediment to the outward northern flow of the gulf stream, and thereby causing more of an eddy than would otherwise be produced. This backing of the warm water of the great ocean-river at a point nearly, if not quite, opposite our Capes, is, I believe, the true explanation of the mildness of our climate. That it is not due to latitude, is evident from the fact that it becomes colder the farther you recede from the seacoast. The winter isotherm of Norfolk, instead of following the line of latitude across the continent, rapidly dips toward the south and enters the northern part of Louisiana. A glance at any of the weather maps issued by the Signal Service, will convince us of this and will show that we have in Norfolk, during winter, the same temperature and climate as Shreveport, La., but in addition to this we have the invigorating salt air from the ocean.

"I do not know of any observations by which the proportion of oxygen or its allotrope, ozone, in the air has been determined, but there is a popular belief (which may be an inference from the exhilaration experienced when first breathing it after coming from an interior locality) that they are in excess.

"If the oxygen be in excess, which is more than probable, it must afford some compensation to the deficient respiration in pulmonary cases.

"Whether or not the excess of oxygen be attributable to the sea air, we have another most important factor in the production of it or its allotropic form in the extensive pine-forests of this region.

"It seems to have been but a recent discovery that the terebenes are generators of ozone; and it may be that this has given the pine forests of Georgia their reputation for benefiting pulmonary diseases. Long before this property of turpentine was known to me, I had been in the habit of employing it by inhalation in cases of phthisis, and with most marked benefit, which I had attributed to some antiseptic power, which it is more than probable it also possesses."

"We have then the very valuable conditions favorable to the treatment of this class of diseases, viz., an equable and mild climate free from the extremes of heat or cold; winds loaded with the exhalations from the ocean, moderated in temperature by having passed, when blowing from any quarter east of the meridian, over the broad expanse of the gulf stream, and when blowing from any quarter west of this line, moderated in force, and becom-

ing charged with ozone by the extensive forests over and through which it must pass.

"Nearly every condition which is here claimed for this region as a health resort is also claimed by different places of resort to the north of us, which have already become popular for the sojourn of invalids. A very little reflection, however, will assure one of their existing to a much more influential extent in this locality.

"Comparing it, for instance, with Atlantic City, N. J., we are considerably further south. The gulf stream, which is the acknowledged factor in moderating the temperature, is only thirty miles from our shore, whereas it is one hundred and fifty miles from the New Jersey coast. There is no growth of wood for many miles from this latter shore, whereas with us the forests almost reach to the ocean's edge. And what is of more value than all these, is the prevalence here of southerly winds, really the extension of the southeast trade-wind; while they blow here a portion of every day, to the north of the Virginia Capes they are not regular, and cannot be relied on. At Norfolk they generally begin to blow about 10 A.M, increase in strength as the day advances, and decline about sun-down, to rise again about 8 or 9 P.M. On the coast they are a couple of hours earlier, and are much stronger. It is this southerly wind that makes this locality tolerable as a place of habitation in the summer. During the daytime it serves to moderate the intense heat, of which we are only conscious at the rare time of calm; or when the sky is overcast with clouds which prevent radiation from the earth or our heated bodies. But if this is sometimes the case during the day, it is seldom or never the case at night, for the delightful southern breeze generally lasts us until morning, so that a warm night is a rare occurrence.

"I am now writing on the 29th day of July, the night preceding which, is the first, this summer, in which I have slept without a blanket.

"Our winters are so mild that fig-trees need no protection; nor do the most tender varieties of magnolia. The grape-myrtle which all summer furnishes such a gorgeous floral display, needs no care, and many of the tender varieties of grape, which, in the northern part of this State, need the warmth and protection of the vinery, flourish here in the open air.

"It is seldom that the thermometer reaches as low as 16° (above zero), and when it does it is for too short a time to do much injury.

"We have snow occasionally, but it generally melts as it falls. I have known one or two sleighing frolics to last a couple of days.

"What cold we have, we value and need for the crippling of the malarial germs, and the destruction of some others, such as yellow fever, if it should ever be introduced among us."

This so fully covers the ground as regards Norfolk City and its immediate vicinity, that I shall not consume your time by the addition of any comments of my own, but pass directly on to a consideration and description of Virginia Beach as a winter health resort.

Stretching along the seacoast of Virginia, from Cape Henry in almost a straight line south for more than twenty miles in latitude 35° 26′, longitude 70° 6′, lies a low sandy beach washed by the Atlantic Ocean; no inlet or indentation mars its uniformity or interrupts its remarkable continuity. For many miles below the Cape this strip of sand beach embraces a width of two or three hundred yards, and is almost entirely bare of any vegetation whatever, save at long intervals may be seen spots of sea-grass or patches of stunted bushes.

Immediately bordering on the inland margin of this sandy beach there exists a dense forest of pine, cypress, and oak, which extends as far as the eye can reach, running parallel with the ocean line, and approaching within a few hundred yards of the sea, the broad, dry strip of sand alone intervening.

Just six miles south of Cape Henry on this beach stands the new bathing site of "Virginia Beach."

An intelligent physician who has resided in the immediate vicinity of this spot for more than forty years, writing of this as a suitable locality for a sanitarium, says:

"This shore line embraces, in my estimation, the most eligible locality known on the Atlantic coast for both a summer and winter resort. It is the only beach where the forest is in close proximity to the sea. In its entirety it is altogether free from all malarial infection. The seacoast extending for miles below this point, and as far north as Cape Henry, has not presented for the last forty years a single case of intermittent or remittent fever that originated among the fishermen, sailors, wreckers, and soldiers, while sojourning here in tents or huts."

Notwithstanding the apparent difficulty of establishing an efficient drainage upon a surface so flat and level, I am told by competent engineers that this can be easily overcome by proper sanitary engineering, and all sources of impurities incident to human habitation readily removed without resorting to the expensive though admirable plan in operation at Atlantic City.

The extensive forest above alluded to, immediately contiguous to the beach, at this point, composed principally of pine and other winter greens, affords an efficient protection during the winter from the northwest winds, whilst it aids in keeping the earth damp and cool during the summer months, and prevents the invasion of malarious influences which may arise at points further in the interior of the country. The temperature of woodland districts, it has been shown, averages about 3° F. lower than that of the open country during daylight, and an average humidity of 9.3 per day higher in the summer. It is not to

be denied that during the heated term embracing the months of July, August, and September, the temperature at this point, as well as all others along the Atlantic seacoast south of Newport, Rhode Island, is at times oppressive, but measurably tempered by the delightful sea breeze prevailing from 11 A.M. to past midnight. It is, however, as a winter resort for invalids that I desire especially to invite the attention of this Association to this locality. Compared with Atlantic City and Fortress Monroe, the two localities on our immediate seacoast most frequented as winter resorts, we cannot fail to recognize its superior natural advantages. Nature has endowed it with those supreme attributes of sanitary power beyond the capacity of man to give. It now only remains for science and art to avail themselves of this beneficent boon, and secure for deteriorated and suffering humanity a haven of repose and recuperation. At present the accommodations consist of a large open pavilion, capable of seating 3000 persons, to which is attached a small hotel. This building is situated about one hundred yards from the edge of the water, directly upon the dry sand. To the rear of it stand the pine forests, and about three hundred yards beyond a small lake of fresh water, into which the sewer-pipe from the building at present empties.

The most extraordinary feature of this spot is its remarkable dryness. Table-salt when exposed during the entire day has been found to remain perfectly free from moisture, differing in this particular from any other seacoast health resort which has come under my observation. The records kept by the United States Signal Bureau show an average difference in temperature between Virginia Beach and Atlantic City, during the winter months, of about nine degrees in favor of the former, and nearly the same between that of Fortress Monroe, notwithstanding the two latter are but twenty-five miles apart.

This is more clearly shown by the following table of average temperature and average humidity, prepared with great labor and much calculation for the months of January, February, and March, 1886, comparing the two points of Virginia Beach and Atlantic City:

THERMOMETER.

Average thermometer at Atlantic City for January, 1886. Taken by Government observers, five times a day.	30.8°
Virginia Beach, same month	34.6°
Average thermometer, Atlantic City, February, 1886 . .	29.7°
" " Virginia Beach, February, 1886 . .	39.1°
" " Atlantic City, March, 1886 . . .	38.2°
" " Virginia Beach, March, 1886 . .	45.2°

Humidity.

Average humidity, Atlantic City, from Government observation, five times a day.

Average humidity,	Atlantic City, January, 1886	82.2
" "	Virginia Beach, January, 1886	78.4
" "	Atlantic City, February, 1886	78.8
" "	Virginia Beach, February, 1886	73.0
" "	Atlantic City, March, 1886	76.4
" "	Virginia Beach, March, 1886	72.8

Atlantic City, highest average day thermometer,	January, 1886,	40.3°
Virginia Beach, " " " "	" "	54.0°
Atlantic City, " " " "	February, "	41.3°
Virginia Beach, " " " "	" "	59.2°
Atlantic City, " " " "	March, "	50.1°
Virginia Beach, " " " "	" "	66.6°

Atlantic City, lowest average day thermometer,	January, 1886,	10.2°
Virginia Beach, " " " "	" "	17.6°
Atlantic City, " " " "	February, "	5.2°
Virginia Beach, " " " "	" "	12.2°
Atlantic City, " " " "	March "	20.1°
Virginia Beach, " " " "	" "	34.2°

In point, then, both of temperature and humidity, it is thus clearly demonstrated that Virginia Beach possesses a marked advantage.

The explanation of the discrepancy referred to, between Old Point and Virginia Beach, may be found in the fact that Old Point Comfort stands just twenty miles inland from the Capes, although located immediately on Hampton Roads. The sea air sweeping in through the two Capes has to traverse a space of twenty miles over this body of cold water before it reaches the Fort, and necessarily loses in its passage the thermal influence of the gulf stream, besides being deprived of some of the original saline constituents held in suspension.

The approaches to Virginia Beach, at present, consist in a narrow-gauge railroad running from the city of Norfolk directly to the sea-coast at this point, a distance of eighteen miles. There is also a shell road in good condition connecting Norfolk with the Beach.

In conclusion, I desire to add that whilst at present the limited and imperfect accommodations render this place ineligible as a winter residence, its superior and extraordinary inherent advantages cannot fail to attract the attention of the sanitarian, as well as capitalists, at no very distant day, and that we may confidently predict for it a successful and important future as a winter health resort.

Although not directly pertinent to the question being discussed, I may here mention, in connection with the geographical features of our Atlantic Coast, extending from this point as far south as Florida, a fact not generally known, but one of national importance as regards strategic advantage in a military point of view, and of economy in a commercial aspect. The fresh water lake already referred to, standing in the rear of Virginia Beach, is but one of a chain of lakes or bodies of water which extend from Hampton Roads to Florida. I am informed by an experienced engineer, who has personally inspected this region of country, that these areas of water lie so contiguous to each other that it would only require a series of short canals to connect the whole, capable of floating light draft steamers, and thus establish an inland navigation extending from the Chesapeake Bay to the State of Florida. The vast importance of such a connection between these two points in the event of a foreign war, as well as to commerce in times of peace, can scarcely be overestimated.

DISCUSSION.

Dr. Walter Platt, of Baltimore, said: I would call attention to the fact that in death statistics there is a source of fallacy, especially when they relate to thinly settled districts. One can count on his fingers the cities in which such statistics have any value. In thinly settled districts little reliance is to be placed upon statistics relating to disease as a whole, or to special diseases. Under such circumstances, where persons live far apart, deaths are not reported in many cases. I think that the small number of deaths reported from country districts may be due partly to this fact, and not entirely to the greater healthfulness of the country.

Dr. F. Donaldson, Jr., of Baltimore, said: Last year, at the suggestion of Dr. Pepper, I tried to get the distribution of phthisis in the State of Maryland, but after consultation with a prominent authority, I gave it up, as he told me that there were no statistics in the city of Baltimore or in the State of Maryland—and, in fact, a good deal further south—that were worth anything. Although published in the census reports, they were not such as to permit any conclusions to be drawn that could be relied upon as correct.

Dr. Garnett said: I do not know that I can undertake to defend the reliability of the Census Department, which was the only source of information that I had at my command. I relied entirely upon the statistics as found in the census reports, which were taken by scientific men and under the direction of the general Government. If we are to

exclude the results found in these reports, I think that we shall throw away a great deal of valuable information, not only with reference to health, but also to other affairs of this Government.

I have made no personal examination of the statistics of this region. I have referred to the general impression which has existed for a long time and to the traditional idea that phthisis was exceedingly rare, sustained by statements of local physicians. I do not know that we can arrive at absolutely conclusive proof from any statistics unless they are brought under our immediate observation, so that we are willing to vouch for their authenticity.

I should like to ask those who question the sources of information to state on what they base their criticisms. The census reports are the only ones which we have to rely upon in regard to important public interests, as agriculture, commerce, etc. I do not see why we should not disregard their conclusions in other departments if we are to do so in reference to sanitary statistics. If they are presumptively correct in regard to other subjects, why may we not suppose that they approach correctness in sanitary matters also, unless it has been demonstrated by other statistics that they are incorrect?

Dr. W. C. Van Bibber, of Baltimore, said: I am glad to have heard Dr. Garnett's paper, and it is the only one that we have on this region of country. So great is the number of persons who go to these shores that it is important to know something about them. The facts which he has given concerning the climate as compared with more northern and more westerly climates are of great value. As regards the statement that there is no remittent or intermittent fever there, I, for one, would suppose it to be correct. With reference to the statistics of the Census Bureau, they are the best that we have, and in the main I think that they are correct; for some places they may not be accurately correct. We cannot have accuracy all at once. In the main, I should think that the maps of Professor Walker are valuable, treating as they do, statistically, many of the most important medical subjects. I was exceedingly glad to hear the paper upon this particular point. It is just what all in this Association needed, as it covers a ground that was entirely barren before.

LOCAL TREATMENT OF DISEASES OF THE BRONCHIAL TUBES AND LUNGS.

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The object of this paper is to describe some of the methods which I have employed in the local treatment of chronic bronchitis, chronic interstitial pneumonia with bronchiectasis, and phthisis pulmonalis, and to give the results which have been obtained.

Chronic Bronchitis.

This disease has been treated by three principal methods: First, by the direct introduction of coarse spray into the air-passages by means of Sass's spray apparatus; second, by the inhaling apparatus of Dr. George A. Evans; and third, by the pneumatic cabinet.

In the use of the direct spray, the principal indications watched for have been the amount and violence of the cough, the amount and character of the expectoration, and the presence or absence of emphysema and asthma. When the cough is severe and spasmodic, the treatment is usually begun by the use of sedative substances, particularly carbolic acid and the fluid extract of hyoscyamus. In using the carbolic acid our custom is first to spray the air-passages with a solution equivalent to that of Dr. Dobell; the formula is:

℞.—Acid. carbol. cryst.	♏ xx.
Sodii bibor.	ʒ iij.
Sodii phosph.	ʒ ij.
Glycerini	℥ j.
Aquæ	℥ vj.—M.

After first cleansing the nasal passages by the use of this spray, the patient is directed to draw out the tongue and take a deep inspiration, during which the spray is thrown into the pharynx, or directly into the larynx by a bent tube, during two or three successive inhalations. A fifty per cent. solution of carbolic acid in glycerine is then added to

the fluid in the flask until the point of tolerance of the patient is reached, and when as strong a solution as can be borne is obtained, the air-passages are sprayed with this five or six times, the patient always inhaling as deeply as possible. If the necessity for it exists, the nasal catarrh is then treated by such application as seems to be indicated. This method of treatment is repeated every day or every other day, as often as is convenient for the patient, no home treatment being employed, though usually some remedies in the way of tonics or alteratives are used internally at the same time.

By this thorough cleansing and disinfecting of the air-passages, combined with the anæsthetic effect of the carbolic acid, the irritation is usually very markedly allayed, so that for twenty-four hours, at least, after the treatment, the cough is diminished in frequency and violence. The method is not always efficacious. It is sometimes necessary to rely, to a great extent, upon sedative drugs, particularly at the outset of the treatment, where the spasmodic character is very well marked.

If the treatment by carbolic acid is inefficient, or if the results come about slowly, fluid extract of hyoscyamus may be either added to or substituted for it, the passages being first cleansed and disinfected by means of the alkaline and carbolic acid solution. A spray of hyoscyamus of the strength of about half a drachm to the ounce is introduced, the application being repeated half a dozen times at each sitting. This solution is particularly efficacious where a tendency to asthma exists.

When there is a very copious secretion of muco-purulent matter, stronger astringents have to be employed. The principal of these are tannic acid, the iron salts, and the fluid extract of pinus canadensis. For the use of tannic acid a standard solution is employed as the basis.

℞.—Acid. carbol. cryst.	. . . . .	♏ xv.
Glyceriti tan.	. . . . .	℥ ijss.
Aquæ menth. pip.	. . . . .	℥ vss.—M.

After the preliminary step of cleansing and disinfecting, this solution is sprayed directly into the air-passages. When the patient has become accustomed to its effects by one or two inhalations, glycerite of tannin is added to it until it is as thick as it can be and be capable of producing a spray.[1] This spray is then inhaled five or six times. Its

[1] The addition of only a very small amount of water is necessary to render the glycerite of tannin sufficiently fluid to produce a spray with a pressure of forty to fifty pounds. Five or six drops of water to a fluid-drachm give a good spray, and ten drops to a drachm make it capable of being sprayed at quite a low pressure—*i. e.*, fifteen or twenty pounds.

effects are often very salutary, the amount of expectoration decreasing perceptibly after each sitting, though the treatment is immediately followed by an increased expectoration, which lasts for from one to three or four hours.

Of the iron salts, I have most frequently employed the chloride, using a mixture of equal parts of the tincture of chloride of iron and glycerine. This is diluted to about twenty-five per cent. and used in the same way as the tannin. Where great relaxation and an anæmic condition of the mucous membrane exist, it acts better than the tannin solution. A solution of iron alum of the strength of fifteen grains to the ounce may also be used, Pinus canadensis is of service in about the same class of cases as are benefited by tannin, though it has a rather more sedative effect than the latter. The preparation usually employed is a mixture of equal parts of Kennedy's white fluid extract and glycerine. The liquid is very heavy and can only be sprayed with a high pressure. To use any of these substances most effectually, it is necessary to have a pressure of from forty to fifty pounds to the square inch. This is obtained by the use of the Crown Gas Engine, manufactured by the National Meter Co., 252 Broadway, New York.

A large tank is connected with the gas engine, which has, by a special contrivance, been converted from a water- to an air-pump, and the compressed air from the larger reservoir is drawn off into an ordinary office receiver at the convenience of the operator. I usually have a pressure of from fifty to sixty pounds to the square inch in the larger reservoir, and, by means of stopcocks, can regulate the pressure in the small office receiver to which the gas is attached, according to the requirements of the case under treatment. Where the nasal passages are very much inflamed and tender, and particularly where there is stenosis, which increases the friction to a high degree, it is better not to go beyond thirty pounds at the beginning of the treatment; but when the swelling of the turbinated bodies and septum has been sufficiently reduced to admit of the free access of air or spray, the passages can be much more thoroughly cleansed and disinfected if we use a pressure of from forty to fifty pounds.

I think it possible that one cause of the avowed failure of certain gentlemen who have recently written upon this subject, to treat successfully nasal catarrhs with the spray, is to be found in the low pressure which they have employed in the introduction of the spray into the nostrils. The degree of pressure required in a given case can be determined in two ways. In the first place, by the amount of resistance which the spray encounters in passing through the nose.

This is quickly shown by the regurgitation of the fluid through the nostril into which it is introduced, and its failure to pass through and out at the opposite side. The second are the sensations of the patient, though the latter generally depend upon the former.

Where the nostrils are sufficiently patulous to admit the spray readily, so that there is little tendency to friction or the development of high pressure in particular localities of the nose, the pain is usually very slight, and a high pressure may be advantageously employed. But where the stenosis is well marked, and the friction consequently very great, there is a tendency for the fluid to accumulate or to be forced violently into the chamber of the antrum, and the pain is sometimes very severe. Under such circumstances the preliminary spraying must be done with a very moderate pressure, and if, even then, the spray does not pass readily through the nostrils, it is better to dilate them by the introduction of cocaine, when no further difficulty of the kind will be experienced. I suspect, however, that the cocaine may to some extent interfere with the therapeutic action of the medicinal agents employed, though it does not, of course, lessen the value of the disinfectants.

In the spraying of the larynx and trachea it is always better to use a very high pressure, and the reasons for this are twofold. In the first place, with the high pressure a very large volume of fluid is introduced in a short space of time, so that in a few seconds an ordinary flask, such as is used in these manipulations, may have its contents half exhausted. And in the second place, the forcible impact against the walls of the mouth and pharynx nebulizes it to such an extent that it is more widely diffused in the respiratory passages. Occasionally a drop of the fluid will form upon the end of the spray tube and fall into the trachea, producing a violent fit of coughing; but, with the high pressure, the time occupied in each introduction of the spray may be so shortened that there is very little danger of this accident.

The advantages to be obtained by this method of treatment over the others to be described later on, are that it occupies very much less time, in consequence of the far larger amount of fluid that can be sprayed into the throat during one or two inhalations, and its better cleansing properties. The forcible introduction of the spray directly into the larynx and trachea gives a much more thorough washing than can be accomplished by the slower methods to be described hereafter.

The treatment of chronic bronchitis by means of the pneumatic cabinet has also been very successful in my hands, as it has in the

hands of other gentlemen who have reported their experience with this instrument. The patient is confined in the cabinet under a negative pressure of from two-tenths to five-tenths of an inch. The sitting usually lasts ten minutes, though it may, after the patient has become accustomed to its use, be prolonged to fifteen or twenty minutes. The pneumatic differentiation is accompanied by the inhalation of the spray, for which purpose we employ the "Evans's inhaler." The solutions most frequently employed by me are, a twenty per cent. solution of carbolic acid, with borax and glycerine, a solution of the fluid extract of pine needles with iodine, and a combination or mixture of the two solutions in equal parts. When asthmatic breathing is present, the solution of hyoscyamus already referred to is of great value. If much emphysema exists, the cabinet is not indicated. I have never seen any benefit derived from its use in these cases, though I have tried both rarefaction and condensation. The inhalation of the hyoscyamus may relieve the asthmatic breathing, but this can be accomplished just as readily outside the cabinet as in it. In one case a sitting of five minutes in the cabinet developed in a very emphysematous subject, whose breathing was fairly good when he entered the cabinet, a most terrible attack of asthma. The moral effect upon the patient was such that he could never be induced to reënter the box, and promptly transferred himself to the care of another physician. I have frequently seen it increase the asthmatic breathing temporarily in such subjects, though in others it has produced temporary relief.

The cabinet is particularly valuable in very chronic and intractable cases where the relaxed vessels of the bronchial mucous membrane, though for a time contracted by the action of stimulant applications, soon resume their previous condition of dilatation. The cabinet undoubtedly acts in a twofold manner in these cases: First, as has been pointed out by Dr. Isaac Hull Platt, in a paper read before this Association at its last meeting, by compression of the bronchial surfaces, and by some alterative effect due, probably, to a combination of the compression with the tonic action upon the vasomotor system of the lungs; secondly, by the action of the spray introduced during treatment. The disadvantage is that, with the spray introduced in this way through the long tube, we do not get the same cleansing effect as can be obtained in the direct method previously described. To obviate this difficulty, I have adopted the practice of first thoroughly cleansing the upper air-passages with the Sass's apparatus before the introduction of the patient into the cabinet.

The apparatus which Dr. George A. Evans introduced to the pro-

fession about two years ago has been used in a number of cases with generally satisfactory results. It consists of an ordinary "Wolff" bottle with a glass globe on top, into one side of which is introduced the point of an ordinary spray tube, while from the other emerges a tube for the collection of pulverized spray. It is a modification of the idea of Sales-Giron, and depends upon the principle that when a coarse spray is forcibly thrown against a surface it will be broken up into minute particles and form a fine nebula which will float in the atmosphere several minutes before being precipitated or evaporated. The grosser part of the spray remains in the globe and falls through a tube, back into the "Wolff" bottle, while the more finely nebulized portion is carried off through the tube of exit, from which it is inhaled by the patient. The mouth-piece consists of a hard rubber tube with an opening on one side, the tube held in the mouth of the patient, and the opening on its side covered by his forefinger during inspiration; during expiration the finger is removed so as to allow the breath and spray to pass out through the side opening. The patient is instructed to make deep and slow inspirations with the idea of securing, as far as possible, voluntary expansion of the chest. The solutions employed have been about the same as those used in the Sass's spray and the pneumatic cabinet.

The advantages claimed by Dr. Evans for his method are that, first, the patient is compelled to make voluntary efforts at deep inspiration during a space of time ranging from half an hour to an hour. By this means a valuable system of pulmonary gymnastics is put into operation. Second, the spray, very finely nebulized, and introduced directly into the air-passages in great volumes, has a better opportunity of diffusing itself in the residual air, and so reaching deeper into the lungs, than it could do under any other circumstances. Third, by means of the fine nebulization much stronger solutions may be employed than with the ordinary coarse spray. For instance, we have frequently employed a thirty per cent. solution of carbolic acid, a strength which could not be tolerated if applied to the air-passages in a liquid form, but which is easily inhaled by any one who is not extraordinarily sensitive.

The first few inhalations of these strong solutions occasion some cough, but this soon passes away, and the patient will continue to inhale for a long time without any further disturbance. At the termination of the sitting, the mouth, pharynx, and larynx, are pretty thoroughly anæsthetized, so that a feeling of numbness exists which lasts for an hour or more. Though the volume of spray as it issues

from the tube seems very large, hanging as a cloud in the atmosphere of the room for a long time, still very little of the fluid is used up in its formation, and not enough is carried into the respiratory passages to have ever produced any symptoms of carbolic acid poisoning in the patients upon whom it was used. As the precipitation of the coarse globules of spray has been thoroughly accomplished before it is introduced into the mouth, no fluid is deposited upon the mucous membranes, but they are simply subject to the mild action of the vapor or spray during the time of the sitting, and the spray itself is all thrown out through the mouth and nose. This method of treatment is particularly useful in cases in which the mucous membranes are extremely sensitive, in those accompanied by violent spasmodic cough, and where the disease is of very long standing, and a prolonged application of the medicinal agent is desirable. Its disadvantage is that, as the spray is introduced by no power except the inspiratory suction, it does not come with sufficient force to the mucous membranes to cleanse them thoroughly. But this objection has been overcome, as in the case of the cabinet patients, by thorough preliminary douching with the spray from the Sass's apparatus. By inhaling through the mouth, and exhaling through the nostrils, medication of the nasal as well as the lower air-passages is obtained.

To get the most satisfactory results by this method it is necessary to employ a high pressure of air. I commonly use a pressure of from fifty to sixty pounds to the square inch. But Dr. Evans, who has a more elaborate apparatus for the compression of air, employs a pressure of seventy to eighty pounds. The advantage consists in the greater volume of spray produced. The inspired air is loaded with it, and during exhalation it pours from the nostrils in a cloud such as is seen to issue from the nostrils of a horse on a very cold and damp day. Where the membranes are very irritable, and the stronger solutions of carbolic acid are not well borne, a mixture of fluid extract of pine needles with iodine is very serviceable, and, as in the case of the Sass's apparatus, it is frequently combined with an equal portion of a ten or fifteen per cent. solution of carbolic acid. I have also used solutions of tannin with the Evans's inhaler, but the spray is exceedingly disagreeable to the patient, and apt to produce nausea. I have not employed any other astringents with this apparatus.

Chronic Interstitial Pneumonia and Bronchiectasis.

By the local treatment of this affection, three objects are to be accomplished. First, the healing of the bronchial catarrh; second,

disinfection of the dilated bronchi; and, third, the restoration of the breathing capacity of such portions of the lungs as are not hopelessly degenerated.

The first two objects are best accomplished by the use of the coarse spray or the Evans's inhaler. Each has its advantages, but so far as I am able to judge from my personal experience, the coarse spray is more serviceable.

The third object is to be accomplished through the use of the pneumatic cabinet, or some other apparatus for the inhalation of compressed air.

The method of treatment is first to wash thoroughly and disinfect the nasal and lower respiratory passages with a coarse spray from the Sass's tube. In the treatment of the lower air passages, a high pressure is necessary, so as to give a large volume of spray, and to project it with great force into the respiratory passages. This is at first productive of violent cough, which clears the secretions from the bronchial tubes, after which the spray is deeply inhaled, penetrating, probably, as low as by any other method. After this preliminary washing, the patient is put into the pneumatic cabinet and subjected to a negative pressure of two- or three-tenths of an inch for from fifteen to twenty minutes, while a mild spray is introduced through the tube in order to keep the mucous membrane of the pharynx moist during the treatment. The application of the pneumatic differential pressure in these cases should be made with the greatest care, as there is danger, if the pressure be too great, of producing emphysema of those portions of the diseased lung which are still accessible to air. For this reason, pressures over half an inch should not be employed. The sitting is made rather longer than in the case of chronic bronchitis, because of the necessity for the use of a lower pressure, and with low pressures, as with mild applications of medicinal agents, a more prolonged use is necessary than where the therapeutic agent is of greater power.

By this combined method of treatment, very brilliant results have been achieved in a number of cases which it is not necessary to detail. In some instances, where the cabinet has not been well borne, or where no manifest results were obtained after a fair trial, the Evans's inhaler has been substituted for it with very gratifying results. In a few cases no benefit has resulted from any local treatment.

Phthisis Pulmonalis.

Aside from the effects of climate, there are no means by which we can obtain so much in the treatment of phthisis pulmonalis as by the

use of agents, either physical or chemical, which act directly upon the respiratory organs.

In speaking of these local measures of treatment, I shall confine myself to the three which I have already discussed, namely, the coarse spray, the Evans's inhaler, and pneumatic cabinet. In the selection of a method of treatment for these cases, it is necessary to take account of all the conditions present, because that which benefits one case may be useless or positively injurious in another.

The best results are obtained either in the early stages, when the disease is in its incipient form and no extensive excavation exists, or where the process, though considerably further advanced, is still limited to a comparatively small portion of the lung. The use of sprays is beneficial only in so far as we desire to treat the coincident bronchitis, or where cavities connect with bronchi of the second or third order—*i. e.*, where they are near enough to the trachea to allow of the introduction of a sufficient quantity of the medicinal agent to disinfect them. In deep-seated cavities, and cheesy collections in the smaller bronchi and alveolar spaces, it is questionable whether a sufficient amount of any agent can be introduced through the trachea to have any therapeutic effect. But in large cavities with a free opening into the bronchial tubes, we may, as in the case of bronchiectasis, expect to obtain a certain amount of disinfection. Where naso-pharyngeal catarrhs exist, they should always be treated the same as in chronic bronchitis.

In incipient phthisis accompanied by very little bronchial catarrh, where the cough is accompanied by the expectoration of only a small amount of mucus, local treatment with sprays is of but little avail, and it is not worth our while to spend much time or worry the patient with it. These cases are best treated by the use of compressed air or the pneumatic cabinet, and in a very large proportion of them we may hope to render the disease latent. The action of the positively or relatively compressed air is to expand the lungs, to favor the expectoration of the contents of the smaller tubes and, possibly, of the alveoli, and to modify the intrathoracic circulation, as has been explained by Dr. Platt, and more recently, by Dr. Tiegel in an able article in the *New Yorker Medicinische Presse* for April, 1887.

The sittings should be frequent, every day, or every second day, and the pressure, at first slight, say two-tenths to three-tenths of an inch of the barometer, should be gradually increased to one-half or even three-quarters of an inch. Ten minutes is usually long enough for each sitting, though in some instances where it is well borne we have

prolonged it to twenty and even twenty-five minutes. There is a great difference in the ability of patients to bear the differential pressure. Some experience no difficulty in inhaling under a negative pressure of one-half or three-quarters of an inch for fifteen or twenty minutes, and say that they feel much more benefit from the treatment than when it is lighter, but others soon become fatigued under the pressure of more than one-half an inch, and, on emerging from the cabinet, show signs of great exhaustion. I have met three or four cases in which the pneumatic treatment had to be abandoned because of the exhaustion and thoracic pain following its employment. A safe rule to adopt is never to make the pressure so high, or the sitting so long, that it is followed by a feeling of weariness or exhaustion. Used cautiously in this way it is, I believe, the very best method for the local treatment of incipient phthisis, or of phthisis limited to a small portion of the apex of one or both lungs. When much bronchial catarrh exists in the earlier stages, the introduction of sprays is all important, and the method is precisely the same as for the treatment of chronic bronchitis. After this preliminary treatment, the pneumatic cabinet is used in the way already described.

So far as the introduction of sprays is concerned, the cabinet is not as useful as either of the other methods; for, while the initial expansion of the lung secured by the operation of compressed air is considerable, the subsequent exhalations do not coincide with it, so that, while the patient is in the cabinet and treated by the diminished pressure, though the chest is expanded and the amount of air actually contained in the lungs increased, this increase is rather in the residual than the tidal air. In some experiments conducted by Dr. Platt and myself, we found that a very robust man could exhale more air after a deep inspiration outside the cabinet than in it. While the expansion of the chest was increased by the action of the compressed air, the expiratory contraction was diminished. Of course, this applies only where the rarefaction is continued during the entire sitting, and would not hold good if the patient were made to inspire under diminished pressure and expire under normal or increased pressure. But after a number of trials, I have not been able to use the cabinet in this way. Mr. Ketchum, the inventor of the cabinet, tells me that he can operate it in this manner, but possibly, from lack of skill in its manipulation, I have not succeeded in doing so.

With the Evans's inhaler in the treatment of the earlier stages of phthisis, my experience is not so great; as the other methods have proved so satisfactory that I do not generally resort to it. Where it

has been used, however, the results have generally been very satisfactory. I believe that its efficacy depends, first, upon the effects of the spray on the mucous membrane of the air-passages, and, second, upon the salutary influence of the prolonged voluntary attempts at deep inspiration on the part of the patient. Under its use the cough and expectoration are markedly diminished, the patient acquires a gradual expansibility of the chest, and the dyspnœa on exertion is markedly diminished. As the natural result of this, the digestion and appetite improve, the sleep is better, and there is a diminution in fever and increase in weight.

The principles involved in the treatment of more advanced cases differ in no respect from those which we apply in the earlier stages, but certain precautions are to be observed, and less is to be expected in the way of a cure. It is possible, however, in many instances, greatly to improve the general health of the patient by diminishing the expectoration, regulating the pulmonary circulation, and increasing the breathing power. Whether anything can be done in the way of disinfection beyond what we have already alluded to, is very doubtful. It would seem, *à priori*, to be impossible to introduce enough of any antiseptic into the lungs to destroy the caseous foci, disinfect the infiltrated tissues in the neighborhood of the avenues of entrance, and leave enough to prevent a reformation of bacilli during the intervals between sittings. To my mind, the only way in which the progress of the tubercular invasion can be arrested is by so improving the nutrition of the tissues of the lung as to render them immune to the disease. We know that in the case of tuberculosis, as of other infectious and septic diseases, it is only a certain proportion of those who are exposed to the infection who contract the malady. Not every patient who is operated upon under circumstances which expose him to septic infection contracts pyæmia or septicæmia, and antiseptic surgery is for the benefit of those who are vulnerable. It need not be applied in every case if we had the means of knowing which were susceptible and which were not. So, in the case of tuberculosis, it is only those whose tissues are susceptible to the disease who contract it. And when the disease is present, in the absence of any means for thoroughly destroying the bacilli which already inhabit the lungs, our only resource is to endeavor to render the remainder of the pulmonary tissue invulnerable to their attacks.

In the treatment of advanced cases our first aim should be to cure the bronchitis, or so to diminish it as to lessen greatly the expectoration and the cough. This being done, the pneumatic treatment should

be carefully applied, in order to get a better expansion and improved circulation, and an alteration of the action of the trophic nerves. The coarse spray, of course, accomplishes but one of these objects, while the pneumatic cabinet and the Evans's inhaler act in both ways. If the cabinet is used, the patient should first be treated locally with the coarse spray, and, after thorough cleansing, the entire respiratory tract should be subjected to a moderate negative pressure, with the introduction of some unirritating spray.

After the employment of a number of different formulæ, it has seemed to me and my two colleagues, Dr. I. H. Platt and Dr. A. H. Buckmaster, that as good results were obtained by the use of a simple alkaline and carbolized solution, as with any of the others; though, in some instances where great irritability was present, a pine needle extract or the fluid extract of hyoscyamus has done better. We used, for some time, a solution of the bichloride of mercury in the strength of 1 to 1000, but it was not as pleasant to the patient as were the others mentioned, and there was no apparent difference in their therapeutic effects, or, if any, it was in favor of the other solutions. Many other formulæ have been used and advised by other observers, but the active principles of all are similar, and as those that we had used acted satisfactorily, it was not thought worth while to multiply them, as no opinion of any value could be formed in regard to the efficacy of any one agent, unless it were used for a long time and in a large number of cases.

Though the effects of the cabinet have been very satisfactory in cases which were not too far advanced, I think that, on the whole, we have been better pleased with the Evans's inhaler. This apparatus has the advantage of being very easily employed. It does not alarm the patient, nor does it fatigue him as much as the cabinet. Of course, if the patient is very ambitious, and exerts himself to inspire as deeply as possible for a long time, he may soon become exhausted. But when the cases are well advanced, and the patients greatly debilitated by disease, we do not at first urge them to make any great effort at expansion, but simply allow them to hold the tube in the mouth and breathe comfortably. As they become accustomed to its use, they inhale more deeply, the respiratory muscles are gradually strengthened by exercise, and they finally become able to make a very effective use of the instrument. We have not employed the local treatment alone in cases of advanced phthisis with extensive destruction of the lung, hectic fever, and copious night-sweats, but have always felt obliged to use other internal medication; so that it is impossible to say, in any given

case, to what extent the improvement which has occurred is due to any one of the means employed, but it would appear that the use of these local measures is a valuable addition to our ordinary therapeutic resources.

It is particularly important, in using the pneumatic cabinet on this class of patients, not to make the pressure too high, as it appears from our observation that where portions of the lung are contracting, no matter how strong a pressure is used, the contraction is not overcome, and any dilatation of the chest which is accomplished is at the expense of the non-infiltrated portions. In one instance the contraction of the lung, which was only apparent above the third rib on the left side at the beginning of treatment, extended, in spite of the daily application of the cabinet, so that, after the lapse of six weeks, it had progressed below the nipple and the anterior border had so far retracted that the cardiac pulsations could be felt over the entire precordial region, from the second intercostal space to the apex. Where this contraction goes on in spite of the judicious use of the cabinet, we may conclude that the instrument is doing no good, and it is as well to resort to other methods of treatment.

We have been somewhat surprised to see tabulated in some of the reports on the use of the pneumatic cabinet, cases of acute phthisis in which cures had been effected. It has been our experience that the more acute the disease, the more rapid its onset, the higher the fever, and the greater and more progressive the emaciation, the less can be accomplished, not only by this, but by any other method of treatment. Indeed, we are unable to report any case which we diagnosticated as acute phthisis, in which local treatment had any effect whatever. The patients are generally very weak, feverish, and irritable, and the application of these local measures simply exhausts them.

I would say, in closing, that the success of the local treatment is largely dependent upon the constitutional condition of the patient. Some, who appeared to have a very trifling amount of local disease, have gone down very rapidly in spite of all that we could do. This has been particularly observed in alcoholic subjects. In one instance, that of a man twenty-eight years old, engaged in the retail liquor business, whose pulmonary difficulty was limited to the upper half of one upper lobe, and consisted largely of solidification without much apparent excavation; and where good results were confidently expected, treatment was found to be very exhausting, and, in spite of the greatest care, the patient rapidly declined. I have been told by Dr. Jacob Fuhs, through whose courtesy we had the opportunity of seeing him,

that he subsequently developed a myelitis followed by paraplegia and rapid dissolution. On the other hand, there have been cases where the disease seemed very far advanced, and extended over a considerable portion of both lungs, which did well from the start, sometimes very much to our surprise. The difference is undoubtedly dependent upon the constitutional resistance of the patient, and we desire particularly to call attention to this fact, in order to illustrate the principle that it is not well either to abandon any case because of its apparently desperate nature, or to base too hopeful a prognosis upon the slight extent of the local lesion.

EVERGREEN FORESTS AS A THERAPEUTIC AGENT IN PULMONARY PHTHISIS.

By ALFRED L. LOOMIS, M.D., LL.D.,
OF NEW YORK.

If one studies the literature of medical climatology, he will find very few well-established facts, or even plausible theories, which satisfactorily explain the beneficial effects of change of climate upon pathological processes. Even the climatic treatment of phthisis, upon which the most careful attention has probably been bestowed, must still be regarded as unsettled.

We are unable as yet to formulate any exact statements as to the influence of even the more potent elements of climate, such as light, heat, and moisture, while our knowledge of the more obscure and imponderable factors is still more uncertain and chaotic.

Even the nomenclature employed by medical writers is inexact and confusing; the terms cold and warm, severe and mild, moist and dry, may each individually find exact expression in figures, but one very soon becomes convinced from his clinical experience that their various combinations can be described in no such definite terms, and that purely meteorological factors are, in themselves, of little value in elucidating the subject, or in leading to safe conclusions.

Neither the density of the atmosphere, the amount of moisture, the equability of the temperature, the barometric oscillations, nor the amount of sunlight, are sufficient data from which to deduce the climatic influence of any locality; for clinical observations have established the fact that places having similar climates, so far as can be determined by their topography and meteorological conditions, have very different therapeutic effects.

As previous investigations have given us full and exact knowledge of the physical elements of climate, the necessary inference from a clinical standpoint was, that there are other unknown agents which either by their presence or absence determine in a large degree the

results obtained in different climates. Modern pathology has given definite form to this clinical deduction.

The revelations of the microscope in the field of bacteriology, have made clear many obscure points, and given a strictly scientific basis to much empirical practice, especially in the treatment of pulmonary phthisis.

All recent writers on climatology seem to agree that the chief factor, and the one common to all localities that furnish favorable results in pulmonary phthisis, is purity of atmosphere. Formerly this term applied almost entirely to purity of physical composition, but more recently, and in the light of advanced pathological investigations, it has come to imply freedom from those floating particles derived from inorganic as well as organic sources, which appear to the naked eye as motes in the sunbeam.

In air which has been rendered impure by the crowding together of human beings, these germs are found in such quantities as to be sensible to both smell and taste, although a large portion are so minute as to be beyond the power of the microscope, and can be detected only by solar rays. Dr. David Young, in his book on the *Tuscan Hills*, says:

"Many of these minute organisms are now well known, and, besides playing a very important part in the causation of disease, they likewise fulfil many functions, not only invaluable but necessary to life. They are the essential agents in the digestion of our food, they make our bread, and turn our grapes into wine, without them our crops would not grow, and much of our dairy produce would be valueless. This teeming world of microscopic life thus contains innumerable agents of minutest form, highly serviceable to man, and many which are equally hurtful, and even fatal to him. Could we discover the means of destroying the latter, mildew and blight would disappear, and many infectious diseases would be unknown."

That there is some intimate connection between the development of the microörganisms of disease and atmospheric impurities, every day's clinical experience seems conclusively to establish. Dr. Angus Smith, in his work on *Air and Rain*, states that we have in the air organized living things which are capable of planting colonies wherever they can find food. These spores may be divided into many classes, the useful and the deleterious, those which promote health, and those which bring disease. The idea of any of them bringing health is not founded on anything positive, but we can scarcely imagine these numberless forms to be all useless. The idea that they bring disease is well confirmed, and ought to be the study of the medical profession.

All varieties of putrefactive bacteria may have an atmospheric origin,

and it is reasonable to suppose that the so-called specific bacilli may have a similar origin. It is to be remembered, however, that I am not now discussing whether the cause of disease be an organic substance formed in the process of decomposition, or an organic germ. But the tendency of inquiry in modern times has been to establish the belief that decomposing substances, both animal and vegetable, produce disease, and are intimately connected with infection and the production of those contagious germs whose absence renders any atmosphere pure or aseptic; such an air must act negatively, rather than positively, if its therapeutic condition be simply that of freedom from septic elements.

Considering, however, the rapidity with which all septic germs multiply, the innumerable sources of their supply, and the freedom and ease with which they are disseminated over large areas, it seems almost necessary to suppose the presence in an aseptic atmosphere of some antiseptic agent. Extreme cold and high altitudes render air aseptic without the presence of any material antiseptic element, but the degree of the one and the extent of the other necessary to produce asepsis are such as to preclude their general employment in the treatment of septic diseases; moreover, clinical experience has shown that such an aseptic air has a less powerful curative effect upon ulcerative and suppurative processes than one in which the aseptic condition is due to the persistent presence of some antiseptic agent of sufficient power to destroy existing septic germs.

The air of high altitudes is aseptic; that of the sea is antiseptic by reason of the bromine and iodine which it contains. Since then the clinical fact is well established that phthisical processes go on far more rapidly in an impure or germ-laden atmosphere, the question is constantly coming to us, Where can we find an atmosphere that is aseptic because it is antiseptic, into which we can send our patients who are suffering from tubercular disease?

Having long since been convinced by my observations that evergreen forests have a powerful purifying effect upon the surrounding atmosphere, and that it is rendered aseptic by the chemical combinations which are constantly going on in them, I invite attention to some conditions existing in such forests, which may explain their therapeutic power.

The belief that the atmosphere of evergreen forests has a curative effect upon persons suffering from pulmonary phthisis is a very old one. Dr. Walsh, in his works on *Diseases of the Chest*, states that the old Romans sent patients with ulcerated lungs to Libra, where, by breathing the balsamic effluvia of the pines, with which the country

abounded, they were said to have lived many years freed from their complaints

The atmosphere of pine forests has always been regarded as most favorable to consumptives by the non-professional public, and there is usually some good ground for a widespread and long-standing non-professional belief in the therapeutic efficacy of any locality. Various attempts have been made to explain the beneficial effect of these forests; some have attributed it to the sedative influence of the terebinthinate vapor constantly floating in the air of such localities, which, by its action on mucous surfaces, arrests diseased processes; others have attributed it to the deoxygenation of the air by the terebinthinal vapors; others to the action of resinous aromata; and still others, to some change in the electrical condition of the atmosphere, the result of the friction of the air against the sharp needles of the evergreen trees.

Such ambiguous terms as "balsamic influence," "health-giving emanations," and "aromatized atmosphere," must be regarded as empty phrases, and meaningless as scientific explanations. The clinical evidence, however, of the beneficial effects of pine forests on phthisical subjects is unquestionable, and it has been accepted by most careful clinical observers that they are an important adjunct in the treatment of phthisis.

The changes attributable to the persistent inhalation of air impregnated with the emanations of such forests are such as to indicate that the atmosphere is not only aseptic, but antiseptic, made antiseptic by some element which is not alone fatal to germ life, but at the same time is stimulant and tonic to normal physiological processes within the lung. Such an antiseptic the chemical laboratory has thus far failed to supply; but as we weigh carefully the facts presented to us in the study of this subject, we are led to the conclusion that this antiseptic element of evergreen forests, an element which is not found elsewhere, is the product of the atmospheric oxidization of turpentine.

It is well known that the turpentines alone have been regarded as of special service in the treatment of all forms of catarrh, especially catarrh of the respiratory surfaces. Atomized solutions and vapors of turpentine have been employed by inhalation in all forms of disease of the respiratory organs, and its internal use has long been regarded as a most valuable remedial agent in the treatment of infectious diseases. Its use in all these different ways has been, to a certain extent, empirical. Dr. Ringer, in his *Handbook of Therapeutics*, states, in addition to its other effects, that turpentine acts antiseptically, passes readily into the blood, and may be detected in the breath and perspiration,

and in an altered state appears in the urine, giving it an odor of violets or mignonette.

Recently terpine, an active principle of turpentine, has been employed in antiseptic surgery, and has proven a most powerful deodorizer and antiseptic, both within and without the body. From these and many other similar facts which might be quoted, it would seem evident that the local and constitutional effects of tupentine are those of a powerful germicide as well as stimulant. Its presence in the atmosphere of pine forests cannot be questioned. Again, ozone is said to be present in excess in the air of evergreen forests, and the beneficial effects of such an air have been ascribed to this substance alone. Soret states that when ozone is brought into contact with turpentine, the whole molecule of ozone is absorbed and no oxygen remains, so that it seems evident that there is a close relation between an excess of ozone in the atmosphere and turpentine exhalation.

Recently the disinfectant property of peroxide of hydrogen has been attracting attention, and it has been shown that it is either fatal to certain forms of germ life or that it renders them inoperative, so that putrefaction processes are arrested or prevented. The oxidizing and antiseptic powers of the peroxide of hydrogen have been proven by numerous experiments, among which may be mentioned those of P. Regnard (*Gazette Médical*, 1880).

The researches of Saböni, made near Moscow, published in the *Bericht Deutsch. Chem. Gesel.*, vol. viii., and abstracted in Pettenkofer and Ziemssen's *Handbuch*, have proved beyond question that peroxide of hydrogen is almost certainly present in varying amounts in the air and rain, and less frequently in snow and hail, and that the amount varies with the season, with the wind, the amount of moisture and in different kinds of forests, the larger amount being found among pines. It has also been demonstrated that all kinds of aromatic plants produce it, and that many natural processes give rise to it which have been regarded as exclusive sources of ozone. As its tests are similar to those for ozone, it has doubtless been mistaken for it, as experiment shows that if turpentine is heated in contact with a stream of air, peroxide of hydrogen is produced.

Mr. Kingsett states that it is probable that each molecule of the oil of turpentine gives rise, in the process of oxidation, to a molecule of the peroxide of hydrogen, and that when turpentine is exposed to the action of the atmosphere it absorbs oxygen and evolves a peculiar organic oxide, which remains dissolved in the turpentine, communicating to the surrounding atmosphere properties similar to those of the

peroxide of hydrogen; also that by natural atmospheric oxidation of the terebinthinates, there is produced in extensive pine forests an almost illimitable amount of peroxide of hydrogen, which renders the atmosphere of such forests antiseptic.

The supposition that peroxide of hydrogen exists in excess in the air of any locality is thus based upon the presence in the air of such localities of the vapor of the oil of turpentine or of other allied substances. It has been shown by Schönbein and others that peroxide of hydrogen may be produced in large quantities by the combined action of air, light, and moisture upon ether, alcohol, oil of turpentine, and other essential oils, and it has been further shown that ozonized turpentine itself contains, not ozone, but peroxide of hydrogen. It seems evident, therefore, that an atmosphere containing the vapor of turpentine or allied substances would be richer in peroxide of hydrogen than that of other situations.

Since putrefactive processes within the pulmonary tissue, no less than in any other situation, are due to, or accompanied by, the presence of various forms of bacteria, the continual bathing of the ulcerated surfaces with such a powerful antiseptic as peroxide of hydrogen, cannot have other than a decided effect in arresting the formation of the products of decomposition. Dr. Clifford Allbutt says (*Lancet*, June, 1878):

"For many years I have held that the majority of phthisical patients die of septicæmia, and that the arrest of this daily repoisoning is a primary object of treatment. To wash, cleanse, and dress ulcers of the lungs by surgical methods is impossible; if, however, there be an aseptic or antiseptic climate, we may hope to counteract this secondary blood poisoning, by sending our patients to live in it. If then an antiseptic atmosphere, although not fatal to the tubercle bacilli, will destroy the products of germ life of septicæmia and pyæmia, it will accomplish much in the arrest of phthisical processes."

The more recent developments in the (Bergeon) treatment of phthisis by gaseous injections, if they shall be found beneficial, are apparently due to the arrest of septic poisoning, and not to destruction of the tubercle bacilli. It is my belief that the atmosphere of evergreen forests acts in a similar manner, and the facts which I have brought before you from many sources, seem to prove that the antiseptic agent which so successfully arrests putrefactive processes and septic poisoning, is the peroxide of hydrogen, formed by the atmospheric oxidation of turpentine vapors.

The crucial test of medicine is not in the cure, but in the prevention of disease, and I fear that the terrible death-rate from pulmonary

phthisis, which has so long defied the advances of medicine, will never be greatly reduced, so long as we confine ourselves to its cure, or attempt to destroy specific bacilli lodged in some endothelial cell or lymphatic capillary. These are the impregnable citidels of germ life. If we hope to destroy them or render them inoperative in phthisical processes, it must be done through the respired air.

It is not possible for every one to take his weak lungs to an aseptic air, but it is possible to render the air of most localities antiseptic; I therefore would impress not only the profession but the public, with the importance of preserving our evergreen forests, and of cultivating about our homes, so far as possible, evergreen trees.

Dr. Dobell states that wherever the pine, with its constant exhalation of turpentine vapor, and its never-failing foliage, can be distributed in a proper proportion to the population among the houses of men, the atmosphere can be kept not only aseptic but antiseptic by nature's own processes, independent of other influences than a certain amount of sunshine and moisture—elements which, like the pine itself, can be found wherever human beings can form a home.

DISCUSSION.

Dr. I. H. Platt, of Lakewood, N. J., said: I have been much interested in this paper, as I have given considerable thought to this question of immunity from phthisis in pine-growing countries, and I have often tried to convince myself that there are emanations from the pines of an antiseptic nature. There are, however, to my mind, certain difficulties in the way, which Dr. Loomis's paper has failed to remove. It is hard for me to believe that there is in the air of pine-growing regions sufficient peroxide of hydrogen, ozone, or other antiseptic agent to produce an antiseptic effect upon the lungs; but, of course, this matter of belief is one into which the personal equation largely enters. There are, however, certain positive facts in the way of the view that evergreen forests do *necessarily* exert a beneficial effect upon phthisis. Why is it that the State of Maine, in which pines are so abundant, has a larger mortality from phthisis than any of the other States? In Maine nearly thirty per cent. of the deaths are from consumption. It occurs to me that the purity of the atmosphere in certain pine regions is due to the fact that the pines grow in sand. In those regions where they grow in sand overlying a clay subsoil, there is no immunity from phthisis, and no special benefit is derived by patients suffering with phthisis. In other parts of the country, as in the pine-belt of New Jersey, the pines grow in ground almost entirely composed of sand for a depth of five or six

hundred feet,[1] and there is, therefore, no opportunity for soil dampness and contamination, which, as Dr. Loomis showed in a previous paper before this Association, are most important elements, producing a condition of the atmosphere favorable for the development of phthisis.

Dr. E. T. Bruen, of Philadelphia, said: I was much interested in Dr. Loomis's paper, and I rise for some information. I think that I understood the speaker correctly as dividing climates into aseptic and antiseptic, and that he thought that a greater degree of value is to be attached to those climates in which the air is perfectly pure than to those to which the air is simply antiseptic. It is recognized that high altitude climates are advantageous largely on account of the aseptic condition from elevation, dryness, etc. The Adirondack atmosphere is remarkably pure and aseptic, and has also the advantage of being an antiseptic climate. Sea air is antiseptic on account of the presence of ozone, but the air is damp, and therefore favors the growth of the microbes of phthisis. I would ask whether or not the dampness which exists in the Adirondack regions as a result of the excessive rains, neutralizes in any way the advantages which accrue from the antiseptic character of the atmosphere induced by the evergreen forests? It has occurred to me that regions of this country which are covered with evergreen forests, and which are not desirable locations for consumptives, are not so because they are damp and unpleasant. The Maine region, and, to a certain extent, the pine region in North Carolina, would illustrate this point. How is it with the Adirondack regions? How does the dampness affect the growth of bacillus of tuberculosis? In what region of the Adirondacks are the evergreen forests most beneficial? To what regions should one go to get the greatest amount of pine air? Is not the Blue Mountain region better supplied with evergreen forests than the St. Regis region?

Dr. B. F. Westbrook, of Brooklyn, said: It seems to me that Dr. Loomis has made an interesting and valuable addition to the literature of this subject, and has gone a step further than many in endeavoring to particularize and to get at the point that we want to know—that is, *what we desire in an atmosphere.* I think, however, that there is one step in our climatological reasoning which bears upon the particular question this morning which has not been taken, and I do not know that it can be taken; and that is, to prove in any way that there is any virtue in pine forests *per se.* It is stated that there is, and as Dr. Loomis has said, these popular beliefs, which have existed for years, are, undoubtedly, founded on experience of some kind, but the ground of the belief is doubtful. Public opinion does not go into particulars. Patients have improved after going into the pine forests, and it is thought that the benefit is due to the trees, but there is no proof that such is the case. I have seen patients improve in pine forests, and I have seen them improve

[1] At Lakewood, N. J., the principal hotel is supplied with water from a driven well over six hundred feet deep, the entire boring being through sand. This great depth of sand I believe to be the main factor in maintaining the healthfulness of that region.

equally in other regions. Pine forests grow in all kinds of soil. In the State of Vermont, where evergreen forests abound, there are some places in which fifty per cent. of the adult population die of phthisis pulmonalis. A gentleman practising medicine in Plattsburg, in the Adirondack region, has informed me that fifty per cent. of the adult population of Plattsburg die of phthisis. He thought that, as the mountain was ascended, the mortality became less. I have been unable to get any information as to the exact mortality among the inhabitants of the mountains. There are other pine regions where phthisis does not prevail. It is, therefore, a question whether or not the pines have anything to do with it, and whether it is not a question of elevation, dryness, structure of the soil, etc. To my mind it would not be any recommendation to a place to state that pines grew there, unless it was also stated that they grew in a sandy or rocky soil.

Dr. J. H. Musser, of Philadelphia, said: I would call the attention of the Association to the paper read at the last meeting by Dr. Pepper, on the "Prevalence of Consumption in the State of Pennsylvania." If my memory serves me, it was shown that in the pine regions of the State the mortality from phthisis was lower, and the degree of prevalence less than in any other portions of the State. Certainly we know that the best health resorts in Pennsylvania are in the pine regions.

Dr. H. F. Williams, of Brooklyn, said: I know something of Maine and New Hampshire, and of the manner of living in those States. I do not think that Dr. Loomis would assert that the influence of pine forests would prevent the appearance of phthisis when other causes far more potent were in action tending to induce the disease. Anyone who studies the home-life and the necessary struggle for existence that most of the people in these States have to endure, especially in those sections where consumption is prevalent, would find influences which pine forests could not destroy. Not only are these people subjected to most violent changes of temperature, but their method of living, so far as regards diet, is very objectionable. They live upon food which tends to destroy digestion. We must also remember that a large portion of the State of Maine is on the seacoast, and that the statistics are not to be relied upon.

Dr. S. Solis Cohen, of Philadelphia, said: Being one of those who are not yet convinced that the *dictum absolutum*, "No bacillus, no tuberculosis," has been proved, the remarks of the last speaker have interested me exceedingly. If the pine forests give an aseptic atmosphere in which micro-organisms cannot exist, and yet those living in these regions and exposed to the climatic, dietetic, and social conditions which have been considered to be causes of phthises, and contract the disease, this fact would appear to be at least a scrap of evidence that the bacillus is not the all-important factor in the causation of phthisis.

I have been much interested in the paper of Dr. Loomis, because it confirms impressions which I have formed from an experience with certain methods for the production at home of an artificial climate, a subject to which I have long devoted attention. I have, like others, seen excellent

results in the alleviation of symptoms in phthisis by the inhalation of terebinthinate vapors, especially where this has been associated with the inhalation of hydrogen dioxide or of oxygen. I have seen laryngeal ulcers cicatrize in a few cases in which the patient has been allowed to breathe oxygen which has been passed through a wash-bottle containing terebene floating on water; and in these cases, too, the ulcer had previously been washed with a solution of the hydrogen dioxide. If this occurs under our sight, it is at least plausible to suppose that the same process may occur in ulcers beyond our sight, provided the medicament can be made to reach the point. That residence in pine forest regions is beneficial in phthisical cases seems to be confirmed by the accumulated experience of physicians of all times and climes; and although we may be able to give no exact data for the formation of this belief, it will require more than the mere expression of a contrary opinion to overthrow it.

Dr. W. E. Ford, of Utica, said: I rise to a question of personal statistics, as it seems to be necessary that one should vouch for the correctness of his statistics. I live so near the Adirondack region that I can speak, to a certain extent, from personal knowledge with regard to the region, its soil, and climate. My residence is not more than two hours' ride by rail from the western side of the Adirondack region. I frequently meet physicians who practise in this region. From conversation with them, I am convinced that phthisis does not develop spontaneously. If the other conditions are such as to furnish a soil in the lungs and the cause of infection is at hand, we may expect the development of the disease. While it is true that only a small proportion of the people living on the border of the forest die of phthisis, yet in the city of Utica a large percentage of the deaths is from phthisis. Two hours' ride north of Utica, the death-rate is much smaller. There is a peculiarity of that region which may be mentioned, and that is, that for the past ten years there have been all along the western border of the Adirondack wilderness, outbreaks of diphtheria of a most fatal type. These have recurred every season. Typhoid fever is not common, showing that the water supply has not been poisoned by the germs which produce typhoid fever, and even in spite of the poor living which these people have and the hardships which they endure, there is very little phthisis that develops spontaneously there.

Dr. P. H. Kretzschmar, of Brooklyn, said: I have been much interested in this discussion of the influence of pine forests on phthisis. I think that there is one point that we should never forget, and that is to combine the different methods of treating phthisis. Yesterday we listened to the excellent paper of Dr. Shattuck, showing that hospital treatment with good sound hygiene and regimen did as much for consumption as any other method of treatment. To-day Dr. Loomis states that the pine forest influence is as beneficial as any other. We shall obtain the best effect by combining the different modes of treatment, and, more than anything else, I believe that it is necessary if we send our patients to pine forests or to other regions, that

we should send them to places where they can be under the careful observation of reliable professional gentlemen. In phthisis the cases should be individualized more than in any other disease. I am of the opinion that the indiscriminate sending of patients to climates which are supposed to have a favorable influence upon pulmonary phthisis is not of such benefit as it has been thought by some. I am a strong believer in the theory advocated by Boenecke, of Germany. The weak heart should be looked after more than is usually done. While we admit that sending patients to high altitudes is dangerous in many cases, yet by sending them to mountainous regions, where, by moderate exercise, they can strengthen the heart-muscle we shall get as much benefit as by sending them to the pine forests. We wish to secure the benefits of a mountain region where the patient is under proper care and where at the same time there is opportunity for moderate exercise to strengthen the heart-muscle and expand the lungs, so as to get all the benefit from the pine forests possible. I lay great stress upon the point that these patients should be sent to places where they can be under the constant supervision of reliable men.

Dr. A. Y. P. Garnett, of Washington, said: I would call the attention of Dr. Westbrook, who is the most pronounced disbeliever in the beneficial influence of pine forest on phthisis, to one fact which seems to be pretty conclusive. There is an island off the coast of Cuba, known as the Isle of Pines. It is sandy and covered with pine trees. According to the statistical records of those who have resided on this island, no cases of consumption originate there. It is regarded as a sanatarium, and persons with a predisposition to pulmonary phthisis are sent there. On a certain portion of the island of Cuba the soil is exactly the same. There is a dry sandy soil, but not covered with pines. Here phthisis occasionally occurs.

Dr. B. F. Westbrook, of New York, said: I want to be understood as saying that, so far as I know, it has not been proven that pine trees exert any active therapeutic influence. The instance that Dr. Garnett has given is the most striking that I have heard. It is a strong argument in favor of the view that the pine trees do some of the work.

Dr. A. L. Loomis, of New York, said: Reference has been made to Maine. The pine region of Maine is fast becoming no longer a pine region. Lumbering interests are divesting it of its pines; besides, Maine has an extensive bleak seacoast, along which a large part of its population live, and I know of no seacoast more favorable for the development of phthisis.

In regard to the Adirondacks, I will say that I long since took the position that moisture is a relative affair, and that it is not the moisture which comes from above, but that which comes from the soil that makes a region unwholesome, especially for phthisical subjects. The soil of the Adirondacks is exceedingly porous, and there is very little surface moisture. It is for that reason that its moist atmosphere is not objectionable.

I do not claim that it is in the pine forests alone that peroxide of hydrogen may be developed. There are other evergreen, and some deciduous forests

in which it may be developed, but it unquestionably is most abundantly developed in pine forests. It should be remembered that pine trees do not grow upon anything but a sandy porous soil. I have never seen them grow in clay.

One gentleman stated that I said that the bacillus cannot exist in such an atmosphere. I did not make any such statement. I stated positively that I did not think that the bacillus was affected by an antiseptic atmosphere. I only claimed that the products of the putrefactive bacilli were affected. These products are poisonous, and it is by their destruction that we relieve the patient.

I do not advocate pine forests as health regions. That was not my intention. I took it for granted that it was an acknowledged fact in the profession that pine forests are beneficial in phthisis. Clinical experience has established that beyond question. I simply endeavored to explain on the basis of physiological conditions the reason of this beneficial influence.

THE CLIMATES OF POINT PINELOS, FLORIDA; AND OF CORONADO BEACH, CALIFORNIA.

By W. C. VAN BIBBER, M.D.,
OF BALTIMORE.

Map-notes.—The two situations mentioned in this paper may be new to many of the gentlemen present; and as I have several maps to show them, I will briefly describe them in the beginning.

Point Pinelos, Florida, is well shown upon coast-chart No. 177, of the U. S. Coast and Geodetic Bureau. It may be called a sub-peninsula. It is called by some of its inhabitants "Florida Minor." It is a unique situation, and puts off from the main peninsula to the south, in a peculiar way. It contains about one hundred and sixty thousand acres of land. For the most part this land is now like a park, the trees are about twenty-five feet apart, and the land is generally high, dry, and healthy. The shores are hard, and are washed by the waters of two bays.

The surface temperature of the water of the Gulf of Mexico is reckoned, in the Coast Survey office, at 87° F.; nine degrees higher than the surface water of the Atlantic Ocean on the same parallel of latitude. What the winter temperature of the water is around Pinelos I do not know.

Permit me here to make a digression from my paper, and call your attention to two facts, simply because they are curious. They are not generally known outside of the Coast and Geodetic office. By means of ingenious diagrams, they are explained to visitors at this office with pride and evident satisfaction, because of the laborious means by which they have been obtained.

1. To the west of Point Pinelos the Gulf of Mexico becomes deep. Sigbey's Deep it is called. The water is 13,000 feet deep over an area of nearly 4,000,000 acres, with a bottom temperature of 37° F.

2. Passing to the south and southeast the water gets deeper, and yet further to the southeast, outside of the Straits of Florida, and near the

north coast of Porto Rico, the water is 37,000 feet deep, with a bottom temperature of 35° F., only three degrees from freezing.

I mention these two facts as illustrations of remarkable geographical conditions; wishing, through them, to attract your attention to the two places which are the subjects of my paper, viz., Point Pinelos, Florida, and Coronado Beach, California, which, of themselves, are examples of remarkable geographical locations, and are said to have peculiar climates.

Coast-chart 606, of the same office, shows the peninsula called on the map "The Island," but which is now called Coronado Beach. It is a sub-peninsula, putting north from the peninsula of Lower California. It contains about 5000 acres, I believe, but the area under improvement now is only 1100 acres. It is on the Pacific Coast, in latitude 32°42′, and as it is now being largely improved demands your attention. All that I know of it I will tell you in this paper.

In the *Journal of the American Medical Association* of May 16, 1885, a paper was published calling the attention of the medical profession to the peculiarities of climate which it was supposed might be found on sub-peninsulas.

In the paper referred to, some statements were made concerning Point Pinelos, Florida, which is one of the large sub-peninsulas of the earth.

It was therein stated that there were peculiarities, of both air and climate, to be found at Point Pinelos which, when they were generally known, might make it a popular winter residence.

One of the peculiarities of this place, mentioned in this paper, was an equable and agreeable temperature, seldom found associated with a sufficient rain-fall.

The average annual temperature of this point was estimated at 72° F. The average temperature for the three winter months I have estimated at about 58° F. to 65° F., according to the season, which was the nearest average I would venture, from the data which I could get.

A second peculiarity mentioned, and a very important one, was that the air seems to be free from that property which produces ague and fever; the intermittent and remittent malarial fevers of physicians; and which is so common throughout this and other countries.

In the paper referred to, the statement was also made that this sub-peninsula was known throughout the State of Florida as the frostless Pinelos, and that on this account a system of hygienic building, a regular water supply, and an improved sanitary drainage, different, it was

supposed, from that at any other place, might be planned and practically put into operation, regardless of the equation of ice; and that there a city, similar to Dr. Richardson's ideal city, might be built with great advantages.

I will explain in this paper what kind of ice may be found at Pinelos, and then each one present can determine the point for himself concerning the adaptability of the climate to the style of building which has been suggested by Dr. Richardson.

In making these statements concerning the climate of Point Pinelos, the writer of the paper was debtor, both to persons of high character who reside upon the sub-peninsula, and also to others who formed their opinions from what they found there, upon personal inspection. The growth and vigor of certain plants and trees, the general lay of the land, and the temperature of the surrounding waters, were some of the things from which these witnesses formed their opinions.

Those who take an interest in this subject now, or who expect to do so hereafter, may have a curiosity to know how the sub-peninsula of Pinelos stood the test of the winter of 1886, which was a remarkable winter in Florida.

The monthly weather review of the General Weather Service of the United States, until recently published under the direction of the late Major-General W. B. Hazen, and now presided over by Brevet-General A. W. Greely, is a work, the great value of which is recognized by all who take an interest in the subject of climate.

On page 2 in the number for January, 1886, can be found this report:

> "Four areas of high pressure appeared during this month . . . only two of these passed eastward to the Atlantic coast. . . the first is probably the most noteworthy which has occurred in the United States in many years, as it was attended by a cold wave which extended over the entire country east of the Rocky Mountains, causing unusually low temperatures, especially in the southern sections of the country. . ."
>
> "Before the 12th of the month," says this same authority, "the cold wave had reached the gulf coast of Florida, causing in many places a lower temperature than had been observed in many years."

I will further quote from the same authority the official record of the temperatures around Pinelos, giving only the minimums, and leaving out the fractions.

The temperature for Pinelos itself, is given upon the authority of Mr. David W. Meeker and Mr. Henry Harrison, who have both kept

a thermometric register at their homes upon this sub-peninsula, more or less constant, for many years.

For convenience, I have arranged the statistics in the following way:

1st. The temperatures along the Gulf coast (four places).

2d. Those in the interior of the State (three places).

3d. Those along the Atlantic coast (two places).

Thus the minimum for the year 1886, and for many years, was

Gulf Coast.		Interior.	
At Pensacola	14°	At Tallahassee	12°
" Cedar Keys	15°	" Jacksonville	14°
" Tampa	19°	" Sanford	21°
" Manatee	23°		
" Pinelos	23°		

Atlantic Coast.

St. Augustine	17°
Merritt's Island (Indian River)	26°

These are the minimum temperatures which occurred at places north and northeast and northwest of Pinelos during 1886.

Although the temperature at Merritt's Island, Indian River, was higher by three degrees than at Pinelos, yet it is fair to say that the wind pressure was from the northeast, and that the cold wave had been warmed by the land of the entire northern portion of the State before it reached Merritt's Island.

It may be interesting to know what kind of ice they have at Pinelos, and something of the details of this remarkable cold wave.

Concerning it, Mr. David W. Meeker, of Pinelos, in a letter dated April 11, 1886, has given the following graphic sketch.

"I saw no ice on Monday, the 11th of January when I arose, but it began to freeze after daylight and froze until noon, thermometer standing about 31°, cloudy, strong winds rather to the west of north; a few snowflakes fell about noon. At 1 P.M. thermometer registered 33° and it warmed up to 36° by 3 P.M. Ice that had formed in tubs loosened from the sides. At 4.30 P.M. I left Mr. Malthy's with thermometer at 36°. As soon as sun went down it grew cold rapidly, and at 8 P.M. was 26°. About 10 P.M., wind calmed down, sky clear. Thermometer ran up to 28° and I thought the worst was over. But in less than half an hour the wind sprang up from a little east of north and thermometer began to fall rapidly; and at 12.30 A.M. had fallen to 25°. The next morning it registered 23°, wind still blowing hard from northeast. After sunrise the thermometer rose rapidly, and by

9 o'clock was above freezing, and at noon was 41° F. The extreme cold lasted about twelve hours. The winters generally are warm and pleasant with an occasional norther."

Mr. Henry Harrison, formerly of London, England, who has lived upon Pinelos many years, says:

"We felt the cold very much during three nights' frost we had in January, 1886. But it is remarkable how little we suffered from it. The recuperative effects of the atmosphere are astonishing . . . I have been at the famous health resorts of northern Italy on the Riviera in December, and in Rome at Christmas time, but my impression is that few places in the world can compare climatically with Florida minor, as I venture to call this point, for the winter half of the year. The more southern end of this point, where I live enjoys exceptional advantages as regards climate. . . Early morning here is simply divine. This very morning (April 12, 1886) at 7 o'clock the easterly breeze was incomparably fine and refreshing."

I have with me the thermometric register kept both by Mr. Meeker and Mr. Harrison, and they show quite agreeable temperature during the winter months.

If we compare this sub-peninsula with the sub-peninsula of Coronado Beach near San Diego, Lower California, where at the present time such large improvements for health accommodations are being made, it will be an interesting matter to decide between Coronado Beach and Pinelos, upon which peninsula the greatest climate advantages preponderate.

No decision can possibly be reached at present, but it will be a study for physicians and sanitarians in the future.

What I know concerning Coronado Beach is at present limited, but as to the rapid march of improvement, my nephew, Mr. Burnet Van Bibber, has written to me under date of April 4, 1887, as follows:

"I was upon the peninsula one year ago when it was a wilderness, dry, barren, and covered with brush. . . I had the honor, if it may be so called, of running the first plow furrow across it . . Now within a year it has water pipes from the mainland across the bay, also an electric cable and telephone. . . The land is laid out in wide streets and planted with trees. A ferry every half hour, houses going up like magic, water piped to every house, and a $250,000 hotel is being built upon what is called Coronado Beach."

Concerning the climate, the same correspondent has written:

"The peninsula has a more equable climate than the mainland. . . The workingmen sleep in the open air. There have been but two rains

since last May. The winter, spring, and fall here, are, as nearly as I can describe it, like one continual Indian summer in the east, only relieved by an occasional storm; sometimes a foggy day; with now and then strong breezes from the Pacific. We also have frosts which run in streaks. The greatest charm about the climate is, the bracing atmosphere combined with a high temperature. When the thermometer reaches 90° or 100° it does not debilitate, as it does in the east."

In the advertisement sheet concerning Coronada Beach it is said, there is no frost, that the thermometer seldom goes above 85° or below 40°. It intimates that the thermometer is most of the time in the seventies, and I expect it is from what I have heard personally from Dr. A. Y. P. Garnett, and Surgeon Matthews, U. S. A., Washington, who are present.

So much for the facts concerning these two remarkable places; and I feel that it may be anticipating matters by a few years; but at present there is very little doubt, in my own mind, that these two great peninsulas, besides being resorted to for pleasure, and also for many diseases on account of their climate; and, especially if they are improved, as it is now proposed to improve them, will be in the near future the great resorts for those affected with diseases of the respiratory organs, and they may also be the battle-grounds, hereafter, upon which the proper climatic treatment of phthisis will be fought.

I will give you my reasons for making these suggestions, and such reasons as I will suggest, are intended only for physicians, because physicians will lead in the study, and must be responsible for the results.

Yesterday many valuable papers were read before this Association concerning the treatment of phthisis. They developed the facts, that some of our members are not entirely agreed about climates, and that some prefer even to treat this disease (consumption) at home.

This latter treatment, I am tempted with extreme diffidence to say is scarcely up to the capabilities of the times, or to the encouragements of this Association. When Aladdin hears the winds howl in the north, and sees the sleet and snow, then he wishes to leave his variegated front, and eat his meat and eggs, and drink his milk, in the sunshine —and who can blame him?

But, be it said, all to his honor, in America he is not selfish. Look at the drift of things? Do they not now move the poor in masses away from their squalid homes into a purer air, amidst more refreshing scenes, and there give them their beef and eggs to eat and their milk to drink,—and the best that Aladdin has—he freely gives them.

If I understand the matter properly now, it is for the climatologists to find the places, and confer with the architects, that they may build properly, and the wealth of the world will see that it is done.

Amongst the reasons I will adduce for the wish prevalent amongst physicians to treat phthisis upon the climate of peninsulas are these, viz., that the real cause of phthisis, and the proper treatment of the disease, are not yet known, and there is a great desire to find out the real cause of the disease; and added to this desire, an abiding interest exists to establish its proper treatment. The one depends upon the other.

Concerning the study of this disease, let us look at the past, consult the present, and endeavor to read the leaves of the future.

About half a century ago, the followers of Laennec sought, found, explained, and taught, phthisis, or consumption, by the nomenclature of crude, amorphous, miliary, disseminated, aggregated, hard or softened tubercle, and measured the disease by the rational symptoms and the physical signs to be found in each individual case.

Now, superadded to these signs and symptoms, by the followers of Koch and other microscopists, it is explained, studied, prognosticated, and taught, by the microscope, and the nomenclature is changed, to the invasion of bacilli, and its progress is measured by the number of bacilli supposed to be making the invasion.

Once it was spoken of as the galloping consumption, phthisis florida, or acute tuberculosis; now the tendency in nomenclature is, whether truly or not, to estimate the force of the disease by the greater or less number of invasionists.

Of those who follow the trend of the "collective investigations" now in progress in England and Germany, and which are so ably summed up by Dr. August Hirsh, in his hand-book of *Geographical and Historical Pathology*, recently issued by the Sydenham Society, the most prudent of us will linger yet for a time before adopting this change of nomenclature.

Yet it is, beyond doubt, a fact that the advance in the *study* has begun, and the climate investigators must now industriously add their quota to the general fund of knowledge. There is no help for it; our volunteered labor is in great part associated with the treatment of this disease, together with other diseases of the respiratory and circulatory organs, and we cannot escape history, as it will be written and recorded concerning our labors.

In my own opinion, the observations and studies of climatologists have heretofore been wisely and judiciously broadly scattered over the

earth, but now I think they may, with advantage, be contracted and specialized.

For example, how many amongst us here to-day, in the discussion of this subject, will maintain that the climate treatment of well-defined phthisis or true consumption, in rigorous climates, in any large number of cases, is not a thing of the past?

It seems to me that instinct, experience, and reasoning combine in searching for a pure air, in a temperate and equable climate, during the winter months. The improved facilities of transportation give ample opportunities for the advantages of changing climates with the seasons.

In this connection it may be observed, that I have said "of well-defined phthisis or true consumption," and by this I mean to exclude the treatment of many cases of "pseudo-phthisis" which may be related outside of the profession in an off-hand and general way; but I allude entirely to cases concerning which special diagnosticians and microscopists have agreed.

Yet, even in this or any other disease, climate is not all, go where you will. There must be provided proper shelter, food, raiment, and medicines to suit the climate and the disease.

If the world wish to be benefited in proportion to their means, they must, of necessity, harken unto the call of their leaders, and build and prepare what is necessary for treatment according to the advanced study of their scientists.

Upon their part, physicians must consult and try to agree upon the best places for the ends proposed.

Look over the map of the world, and show two places which offer superior advantages to those just mentioned. Go to either of these peninsulas in the winter and you will see numbers of men congregated there. Speak to one of them, and he will answer for the rest, and will say, "I was in Dakota, or Maine—and had a cough—and I came here —and am better.

Neither one of these two peninsulas has a climate sufficiently hot to debilitate the system, or too cool to be disagreeable in winter. They might theoretically be supposed to be well adapted, in climate, to those from the further north as well as to those from the further south—bracing and invigorating alike to both.

The fact of the existence of frost will render it necessary, in building, to make ample provision for changing the air of each shelter apartment by forced ventilation, and of purifying it by fire.

The occasional frost may also have a good effect in keeping the air free from the ague and fever malaria.

Neither of these peninsulas is warm enough to produce or engender the liver troubles of the tropics.

Moreover, they are both of them freely accessible by land and by water, and offer, to a rare extent, the full advantages of both these elements, by imparting to the air that peculiar quality which only peninsulas can give.

Besides this they afford the greatest variety of food.

From their situations, they give peculiar opportunities for the most healthful exercises, amusements, and recreations for both body and mind to suit all tastes.

From their topography and nebular phenomena they charm the eye with extended views of earth, firmament, and clouds.

And yet, so far as I know, there is a sufficient difference between them to give an interest to a discriminating study.

One of them may have an air drier than the other, and one may add the healing balsamic odors of its pine groves to other agreeable and healthful properties of its air.

Without going further into details, let me trust that I have not fatigued you with my anticipations, and permit me to conclude with the hope that, in the future, a positive benefit may come to mankind at large, and to the influence of this Society in particular, from a more elaborated and detailed study of these two choice situations, or of situations that are even yet more fitted to the ends proposed.

DISCUSSION.

Dr. F. I. Knight, of Boston, said: I have been particularly pleased with the broad views of therapy expressed by the members of this Association, and one which I attended last week. At the recent meeting of the Laryngological Society there was a very general expression of opinion in regard to the treatment of hay fever, asthma, etc., by operating on the nose. The opinion was almost universal that that was a means of relief in one class of cases, but that, as educated men, we must not lose sight of other causes and other therapeutic measures, nor the constitutional predisposition, and the general treatment which is necessary for the cure in the vast majority of these cases.

Here it is gratifying to see that men are not claiming certain climates as curative, or rectal injections as curative, but that we shall go before the

public as broad-minded physicians who try to make an intelligent use of therapeutic measures which are recommended to them.

With reference to climate, we cannot recommend a certain climate for a certain disease. We cannot say that Florida or Colorado is good for consumption. We must consider the individual indications in each case. That is the direction in which we need to direct our studies. It is hard to form opinions as to the effect of any climate on our patients. If I had been asked personally whether I thought that my patients had been benefited by the atmosphere of pine forests, I do not know that I could have said that they had been. I have seen patients do well in all sorts of climates, because their mode of living was changed. In regard to the special climate to be selected, we have a good deal to consider. My practice in threatened tuberculosis, or where only the early signs are present, is to send the patient to mountainous regions, particularly Colorado. This is my first choice in cases where there are no contraindications such as high temperature or nervous temperament. There is another class including those of a nervous temperament—ladies, for instance, who cannot exercise in the open air sufficiently to keep warm in a cold climate, and cases of highly advanced disease. In this class I send the patients to such resorts as the Pinelos region. So far as I can judge from my personal experience, it is better to send young men who have sufficient strength to exercise in the open air, to a cold climate rather than to a warm one.

Dr. G. P. Shirmer, of New York, said: Some four years ago, I went to Point Pinelos with a member of my family, who suffered with pulmonary disease. I experienced quite a degree of dampness, which was not prevalent in the interior of the State. I am inclined to rheumatism myself, and the dampness affected me. I went then into the interior from Tampa, in the same latitude, and there the dampness was much less. There I slept on the ground for two or three weeks, without any indication of rheumatic trouble. There are intervals of six or eight weeks during the winter in which there is no rain, and perhaps only a shower during the whole five months. I have the reports of two rains during the past winter. These lasted from three to five hours.

The depth of the sub-soil from the surface varies in different parts of the State. In some parts it is, perhaps, not more than four to six feet from the surface, and the wells in that region are only eight or ten feet deep. In the interior of the State the wells are thirty feet deep, showing that the soil is perfectly dry. The temperature varies during the winter from 60° to 85°.

ENVIRONMENT IN ITS RELATION TO THE PROGRESS OF BACTERIAL INVASION IN TUBERCULOSIS.

By E. L. TRUDEAU, M.D.,
OF SARANAC LAKE, N. Y.

Though much light has been thrown of late on the etiology of tuberculosis by the labors of Koch, Baumgarten, Weigert, and others, the conditions which lead to tubercular infection are yet shrouded in mystery, and many clinical facts and teachings remain seemingly at variance with the new doctrine. The older clinical medicine on one side points to unhygienic surroundings, malnutrition, struma, defect of anatomical structure, and heredity as the main causes of tubercular disease, while experimental research brings evidence not easily to be thrust aside to support its claim to have discovered in the bacillus tuberculosis the virus which is essential to the production of this fatal class of maladies.

The acknowledged causes of consumption may conveniently be divided into those operating before, and after birth, the former coming under the general heading of heredity, the latter of environment. The problems of heredity are most complex and reach, as yet, far into the domain of hypothesis; but the effect of environment in its relation to bacillary invasion may more readily be subjected to study. So much do certain conditions of air, light, food, and especially habitation influence the etiological history of the development of consumption that a prediction as to the prevalence of the disease in any given locality may often be based on a thorough knowledge of these conditions. Drs. Bowditch and Pepper[1] in this country, and Dr. Buchanan[2] in England, have done most valuable work in this direction and the results of their labors alone seem sufficient to establish the fact that environment is a most potent factor in the causation of tuberculosis. What, however, are its relations, if any, to the development and prog-

[1] New York Medical Journal, Dec. 4, 1886.
[2] Ninth and Tenth Report, Medical Officer, Privy Council, 65–67.

ress of bacillary invasion? To determine how far extremes of environment favor or arrest the progress of germ infection and to what degree they are mutually or independently concerned in the causation of tuberculosis, has been the object of this research and an answer to the three following questions sought.

First. What results ensue when both bacillary infection and unhygienic surroundings are made to coexist in tuberculosis?

Second. Are unhygienic surroundings, when every known precaution has been taken to exclude the bacillus, sufficient of themselves to bring about the disease?

Third. Is bacillary infection invariably progressive in animals placed under the best conditions of environment attainable?

EXPERIMENTS.—Fifteen rabbits were made use of and divided in three lots, each set of animals being placed under conditions best adapted to answer in the results noted the three questions already referred to.

Experiment No. 1. Five rabbits were inoculated in the right lung and in the left side of the neck with five minims of sterilized water in which was suspended a sufficient quantity of a pure culture (third generation) of the tubercle bacillus to render the liquid quite perceptibly turbid. The needle of the Koch's inoculating syringe was inserted subcutaneously on the left side of the neck and in the third intercostal space to a depth of thirty millimetres on the right side. These animals were then confined in a small box and put in a dark cellar. They were thus deprived of light, fresh air, and exercise, and were also stinted in the quantity of food given them while being themselves artificially infected with the tubercle bacillus.

Experiment No. 2. Five healthy rabbits were placed under the following conditions: A fresh hole about ten feet deep was dug in the middle of a field, and the animals having been confined in a small box with high sides but no top, were lowered to the bottom of this pit, the mouth of which was then covered with boards and fresh earth. Through this covering a small trap door was cut which was only opened long enough each day to allow of the food, consisting of a small potato to each rabbit, being thrown to the animals. So damp was the ground at the bottom of this pit that the box in which the rabbits were confined was constantly wet. Thus these animals were deprived of light, fresh air, and exercise, furnished with but a scanty supply of food while breathing a chill and damp atmosphere, though free from disease themselves and removed as far as possible from any accidental source of bacterial infection.

Experiment No. 3. Five rabbits having been inoculated in precisely the same manner as the animals in the first experiment, were at once turned loose on a small island in June, 1886. It would be difficult to imagine conditions better suited to stimulate the vitality of these animals to the highest

point than were here provided. They lived all the time in the sunshine and fresh air, and soon acquired the habit of constant motion so common in wild animals. The grass and green shrubs on the island afforded all the fresh food necessary and in addition they were daily provided with an abundant supply of vegetables. Thus, while artificially infected themselves they were placed in the midst of conditions well adapted to stimulate their vital powers to the highest point attainable.

RESULTS —*Experiment No.* 1. Four of the inoculated rabbits confined in the cellar died within three months: in all of them the injected lung was extensively diseased; the other lung and the bronchial glands being also more or less involved and tubercles in various stages, but sufficiently advanced to be macroscopical, were found in the pleura, peritoneum, spleen, and liver; from these lesions pure cultures of tubercle bacilli were obtained. The fifth rabbit survived and was killed four months after injection; at the autopsy the right lung was found solidified and shrivelled, the upper portion being almost entirely destroyed, while a bronchial gland as large as a hazelnut, filled with creamy pus, occupied the right chest; tubercles, which in many places had become cheesy, studded the upper portion of the left lung. The other organs were healthy.

Experiment No. 2. The five uninoculated and healthy rabbits placed in the damp pit were all living at the end of four months. They were emaciated and their coats were rough, but they still seemed about as active as at the beginning of the experiment. They were all killed within a few days of each other, but a careful examination of their organs revealed nothing abnormal in any of them.

Experiment No. 3. One of the five rabbits which were allowed to run at large died just one month after inoculation. The lower portion of the lung was solidified, the bronchial glands enlarged, as well as the axillary glands on the left side, and a few tubercles were made out in the spleen. The left lung and all the other organs were sound. The four other rabbits remained apparently in perfect health, and so active had they become that two of them could only be captured with the aid of a gun. All four animals were killed at the beginning of November, or four months after inoculation. They were loaded with adipose tissue and their flesh was so firm and red as to be in striking contrast to the blanched and flabby muscles of the other rabbits previously examined. All the organs were healthy and even the points of inoculation could not be made out.

A review of the evidence afforded by these experiments confirms the view that the production of tuberculosis is a most complex problem and one in which many elements besides the bacillus enter. How surely and rapidly this microbe accomplishes its work when the normal resisting power of the system is for any cause lowered, is well shown by the manner in which the first lot of animals succumbed. Localized tuberculosis was in every instance but one quickly followed by general

systemic infection and death. That animals kept in most laboratories are frequently confined under conditions of air, light, and overcrowding, which may materially influence the results of investigations in a disease of the nature of tuberculosis, can hardly be denied and should be kept in view.

Necessarily imperfect so far as affording protection from bacillary infection as were the conditions under which the animals in Experiment No. 2 were placed, the results obtained seem to indicate that unfavorable environment and the consequent malnutrition which invariably follows existence amidst unhygienic surroundings are not sufficient of themselves to cause tuberculosis. The fate of the animals allowed to run wild is most instructive, inasmuch as it seems to indicate that in a great majority of instances resistance to the invasion of so deadly a germ as the tubercle bacillus is possible in the artificially produced disease, provided the vital and nutritive processes of the animal are stimulated to the highest possible state of activity.

In estimating, however, the power of environment in rendering these rabbits insusceptible to the disease, it must be remembered that in them the tuberculosis was an artificial one, produced in previously sound animals, and not the culmination, as in the spontaneous disease in man and animals, of many debilitating causes, acting often through long periods of time, and impairing the resisting power of the system to such a degree as to allow of spontaneous infection. That incipient phthisis is frequently recovered from is demonstrated by the results of autopsies on individuals dying from other causes, and by a long list of clinical observations. The interesting cases of tubercular inoculation in circumcised children recently reported by Lehman,[1] furnish proof that so large a number as thirty per cent. of recoveries may occur, after artificial inoculation in healthy subjects, even when profound systemic infection has existed. Experimental research has already furnished proof of the potency of environment in determining microbic disease in animals otherwise insusceptible. Thus, Pasteur[2] succeeded in killing hens with anthrax, after reducing their naturally high temperature by keeping them partially immersed in cold water, though these birds in their usual surroundings are proof against this microbe. Gibier[3] gave the same disease to fish, and Metzchinkoff[4] to frogs, by warming the water in which they lived, after failing to infect them in their natural environment. Wild animals and game birds, which, in their wild

[1] Deutsch. med. Wochensch., 1886, Nos. 9–13.
[2] Les Bacteries, Cornil and Babes, page 582.
[3] Ibid., page 581.
[4] Virchow's Archiv, vol. xlviii. p. 503.

state, are never known to die of tuberculosis, rapidly succumb to the malady when placed in confinement, and the North American Indians, among whom phthisis is practically unknown while living a savage life, are decimated by consumption when placed under the trying restrictions of a more civilized mode of existence.

If, therefore, environment is so potent a factor in determining bacterial infection, are its effects on the future course of the malady when it has occurred to be disregarded? How potent may be its influence is demonstrated by the widely differing results obtained in the inoculated rabbits allowed to run wild, and those confined amidst unhygienic surroundings. That it is not, however, more than a predisposing cause of the disease, seems indicated by the survival of the animals in Experiment No. 2, which, though they were deprived of fresh air, light, and exercise, and stinted in the amount and quality of their food for over three months, developed no organic lesions. Thus it would seem that the local mischief having been produced, the future type assumed by the morbid processes, and even the ultimate result, is greatly dependent on the resisting power evinced by the individual, which may be computed as the sum total of all the conditions which affect individual vitality through heredity and environment.

The two ultimate elements in this struggle for existence are the bacillus and the cell. Though in its infancy, bacteriology already points to the cell as an active factor in resisting the progress of bacterial invasion. Metzchinkoff[1] saw the lymph cells of the frog englobe and destroy anthrax bacilli, and Wyssokowitsch[2] found the microbes which he injected in the circulation of animals, taken up by the endothelial cells lining the capillaries of various organs, where they finally became destroyed. Suppuration is now being looked upon by some as a conservative process in which the leucocytes are thrown out in great numbers, to destroy bacteria, and as a barrier to systemic infection. The peculiar relation of the bacilli to the nuclei in the giant cells themselves, suggests the possibility of an antagonism between the two. As the pathogenic qualities of infectious germs may in many instances be abrogated or diminished at will, as in the preliminary manipulation of bacteria used in vaccinations, by placing them under peculiar conditions of environment which rob them of their virulence, or modify it, so may the resisting power of their natural enemies, the cells of the body, be diminished or increased by the same means. Watson Cheyne, in a review of some of his recent experiments, after describing the manner

[1] Virchow's Archiv, vol. xlviii. p. 502.

[2] Ueber die Shicksal der ins blut injicerten Mikroörganism. Zietschrift für Hygiene, Bd. i. Heft 1.

in which large quantities of putrefactive and non-pathogenic bacteria are destroyed when injected into the blood-current of rabbits, adds "but this does not occur if the animal is in a bad state of health."

Viewed in this light, the teachings of clinical medicine, the knowledge obtained by a study of the therapeutics of the disease, and the proof offered by experimental research, are in perfect accord. All measures which tend to increase the vitality of the body cells have been found to be precisely those which are most effectual in combating tuberculosis; one by one, specific methods of treatment, which for a season enjoyed popularity, have fallen into disuse, and hygiene, climate, and feeding—in other words, a favorable environment—have alone given results which have stood the test of time.

A consideration of the evidence offered by this study, therefore, teaches that though environment may bear but the relation of a predisposing cause to microbic infection, it is, nevertheless, a potent factor in determining the future type, and even the final results of the disease, and that if we may not underestimate the pathogenic properties of the bacillus, the effect of extremes of environment on the resisting power of the cells of the body is an element in this complex problem which should not be ignored.

DISCUSSION.

Dr. A. L. Loomis, of New York, said: It seems to me that this is one of the most valuable and carefully prepared papers that we have had before this society. It gives definite shape to our clinical observations. Long ago the fact that certain surroundings had the power of developing phthisis was admitted by the better members of the profession. Laennec states that in a nunnery near Paris, where the nuns were constantly educated to the most depressing religious truths, every nun who came into the nunnery during a period of ten years died of phthisis. It was found afterward that this nunnery was built in a clay cup and had to be abandoned on account of its unhealthfulness. This is simply a clinical fact. To-day we have something definite in the way of experiments with reference to this subject. It seems to me that this line of study is going to help us to explain our clinical facts.

THE CLIMATE OF ST. MORITZ, UPPER ENGADINE, SWITZERLAND.

By WALTER B. PLATT, M.D., F.R.C.S. (Eng.),
OF BALTIMORE.

In bringing St. Moritz, a Swiss village in the Upper Engadine Valley, to your notice as a health resort, the writer is aware that it is well known in a general way to be a "good place for consumptives," as it is termed. How good, what other patients and diseases are likely to receive benefit, and in what way, are questions we shall attempt to answer.

Where there are a number of places at which a certain class of invalids improve or recover, an intelligent choice of one locality rather than another, often depends upon the distance, or the total relative expense of getting and living there. To discuss the *climate* of St. Moritz without regard to the other conditions necessary to make it habitable, not to say endurable, would be as much out of place before this Association, as a relation of the climate of the planet Mars. If one cannot eat, sleep, and be reasonably diverted, time were worse than wasted to speak of the rain-fall, the temperature, and the dry atmosphere.

The Engadine is a narrow valley, fifty-seven miles long, which varies from one to two miles in width, and runs northeast and southwest.

It is situated in the southeastern corner of Switzerland, close to the Italian frontier. The valley is bounded by two parallel mountain ridges, and nearly twenty shorter valleys open into it.

The Upper Engadine interests us chiefly, as in the lower part of this, is St. Moritz. The extreme Upper Engadine has a climate which has been compared to that of Finland in its very short summer, and long, very cold winter.

The mean height of the upper valley is 5500 feet above the sea, while St. Moritz itself has an elevation of about 6000 feet. We say *about*, because the upper village, the most desirable part of the town,

is 6100 feet above the sea level, while the "baths," half a mile distant, lie in the plain, 300 feet below.

The Inn river flows along the valley, widening in three places into as many beautiful lakes half a mile to two miles long, and two to three miles apart. Many visitors row or are rowed on the one at St. Moritz.

This Upper Engadine Valley is one of the three highest valleys in civilized Europe.

The two mountain ridges, as well as the many peaks which shut in the Engadine, are covered even in summer with snow almost to their bases, while eight or ten miles distant are two of the finest glaciers in Switzerland easy to visit, and one of them quite safe to follow without a guide. These little matters of topography have a double interest, as affecting the temperature, and affording a great variety of interesting excursions, long or short, difficult or easy.

The writer has visited the Adirondacks, and Southern Georgia, Montana, the Yellowstone region, and Colorado, besides other parts of Switzerland, and believes the climate of Engadine to have peculiar advantages. Everyone who has been there can agree with Dr. Burney Yeo, of London, who says: "The air is perfectly pure, clear, dry, and bracing," and one feels what is usual at high elevations, the desire and ability to walk considerable distances without fatigue. Caution is especially necessary at first, not to overdo this matter of exercise.

In summer more or less rain may be looked for in one day out of three. Yet fog is very unusual, although far from uncommon in many other Swiss valleys. The season begins June 15th and lasts two and a half months.

Phthisical patients who have considerable natural vigor, and who have taken fair care of their health, may arrive June 1st, and remain until November.

October is a delightful but cool month, and September is, on the whole, pleasanter than August if not as warm. Heavy snows begin about November 10th, and the ground is, after this, never free from snow until the end of April.

A record of the temperature kept for eight years, and quoted by Gen. George B. McClellan (who spent some time at St. Moritz), taken at 7 A. M. and 1 and 9 P. M, for the four months of June to September inclusive, showed a mean of 50.72° F., and a daily mean variation of 12° F.

For a period of seven years the lowest temperature observed in the same months was 32.5° F., and the highest 77.9° F. Toward the end

of October the weather begins to be quite cold, and on one occasion skating began October 25th.

We may look at St. Moritz as a summer resort, as a place for winter residence, or in regard to its waters and baths. It is chiefly as a summer resort that it is desirable for tuberculous patients, although numbers do remain, with decided benefit, through the winter.

The advantage of the summer climate is a pure, cool, dry air; there is little or no dust, and the Alpine quiet is very grateful to the patient from town. The disadvantage is, that the daily variation of the thermometer may be considerable. The early morning is cold, the noonday often more than warm, but the early evening is very agreeable. Changes which would be unpleasant in another, damper climate, are of far less consequence in this dry air; in fact, people do not readily "take cold," although acute pulmonary disease, pneumonia, and pleurisy, as well as chronic rheumatism do occur in the acclimatized.

Whether this region can suit people with delicate lungs, is answered by the fact that a large number do well physically, and enjoy themselves at the same time. During the winter of 1882-83 over fifty guests remained at the Kulm Hotel, and some of them spoke to me enthusiastically of the pleasure of the past cold weather, which was spent in skating, sleigh-riding, and coasting.

Two to three feet of snow, and several feet of ice on the lakes is the rule in winter. One agreeable feature of St. Moritz is the fact that, relatively to the well people, but few sick are concentrated in one hotel. This is an advantage appreciated by those who have seen in other places rows of consumptives looking at each other's tongues, feeling one another's pulses, counting coughs, and taking their stimulant in concert.

There are few other trees than pines and larches in the vicinity of St. Moritz, but the flowering plants are marvellous in their variety and color. I have never seen a valley where the meadows and mountain slopes seemed so completely covered with flowers as in the Upper Engadine. Many of them are species peculiar to these altitudes, and quite new to the stranger looking for health or pleasure.

As to the food and hotel accommodations, the best is excellent, and the good very fair. Most of the provisions consumed are brought over the mountain passes from Chur, and, strange to say, it does not make the cost of living excessive, since this is less than in many other places in Switzerland.

The Kulm Hotel is undoubtedly the best place to go (1883). Here one finds the table, the rooms, and the service good. Moreover, the

house has a glass-covered corridor where one may breakfast or walk, when it is too cool or too wet to go out of doors. There are, of course, smaller hotels and some excellent pensions in the upper town (for this is the only part of St. Moritz desirable as a residence). Near the baths, 300 feet below, are also a number of hotels frequented mostly by continental visitors, who attach great importance to the waters. The drainage of the upper town could hardly fail to be good, if given a chance, since the handful of houses making up the village is placed on a steep hillside, which has been made habitable by terracing. The natives are thrifty, peaceable Swiss, who speak a Romance dialect called Ladin, which is believed to resemble closely the ancient spoken Latin.

The country is entirely safe for ladies to walk about alone, indeed, one rarely meets or sees anyone off the highway except the summer visitors.

There are several resident physicians, both Swiss and English, as well as one or two good apothecaries, so that patients need have no fears about medical attendance.

The chief diversions in summer are walking, dining, rowing, or tennis. The Italian boundary is but a few hours distant, an easy walk for a well man, over a fine road and through a beautiful country. Parties are made up almost daily to visit the glaciers or lakes.

A word or two about the waters. There are two springs at St. Moritz, very similar in character, both are cold, having a temperature of 40° F. Both contain comparatively large amounts of calcic carbonates, small quantities of iron, and considerable carbonic acid gas. Their actual value will never be settled until the old dispute is ended about the comparative virtues of the air and water. I believe the waters may do serious damage when drunk cold, and in large quantity indiscriminately.

They are doubtless of benefit in suitable quantities in anæmia, chlorosis, and neurasthenia, but of doubtful use, or else injurious in chronic pulmonary disease.

As far as the waters go, patients would do better to visit some other European chalybeate, since there are many, such as Schwalbach and Pyrmont, richer in iron and yet well borne.

One of the springs at St. Moritz to which public attention was first directed by Paracelsus, was subsequently named after him, and its virtues have been exaggerated ever since. For suitable cases Dr. Burney Yeo suggests the probable advantage of a course of the waters at Tarasp in the Lower Engadine, or at Homburg, where the waters

are aperient as well as chalybeate, and later to take the water for a few weeks at St. Moritz, where it has the latter quality only.

Women at about climateric period are apt to do well at St. Moritz. How much the water by itself accomplishes is problematical.

The baths, which are taken industriously by the Germans, are certainly refreshing. The tubs are of wood, narrow, and coffin-shaped.

The patient being fairly in the tub the lid is put on, leaving only his head out. The water has been previously warmed, and the carbonic acid gas now accumulates in myriads of minute bubbles on the cooler skin of the patient. These finally escape, causing a reddening of the body-surface, and an agreeable prickling sensation, decidedly sedative in its effect upon nervous cases.

The kind of patients most likely to receive benefit by a residence of some months at St. Moritz are cases of early, slowly progressing tuberculosis, where the cough is moderate, range of temperature low, and the strength tolerably well preserved. Particularly are young men apt to do well who have a good frame and physique, and who seem to develop tuberculosis by accident, as it were, and whom nature did not seem to build for the especial purpose of destroying by phthisis.

Plucky girls, who are fond of out-of-door life, full of resources, and who have but recently begun to fail in appetite, and cough, are likely to receive benefit also. Cases of fibroid phthisis do exceedingly well.

The general effect of the air is that of a tonic. Patients eat or sleep better; the cough is less, as a rule, and *some* recover. It is absolutely impossible to make general recommendations apply with certainty to individual cases.

Whether the bacilli in the sputa are less I do not know. The diminution of bacilli in the sputum of a given patient, after a reasonable time, will doubtless be the ultimate test of the curative value of a health resort.

It is now well known that altitudes above 1500 feet are not *necessarily* useful in proportion to their height above the sea-level. Davos Platz, for instance, an excellent place for some cases, as far as climate is concerned, is considerably lower than the Engadine. It is said to have certain disadvantages in other respects not to be underrated.

As before stated, patients who have led a sedentary life, dyspeptics, neurasthenic cases, and pale, fat, catarrhal women, are almost sure to improve.

Those who ought not to come to St. Moritz are elderly people, who are not strong and tough. Moreover, patients with insufficient hearts,

whether they are dilated or fatty or have valvular lesions. These cardiac cases ought not, of course, reside at high elevations anywhere.

Some insomnia is often caused in neurotic individuals for the first few nights of their stay, which may be occasioned by the low atmospheric pressure, the cool rooms, the perfect silence, or all three combined.

The cost must be counted in the pursuit of health as well as of pleasure. $160 will transport one person with comfort from New York to St. Moritz, allowing five to six stops of a day each on the way after leaving Liverpool, and taking sixteen days for the entire journey. Before June 15th the rates for board and room at the best hotel (the Kulm) are (or were) about $10 per week for room with board. During the season room and board are separate, and will amount to $15 to $20 or more. September 1st the old terms are resumed, or special rates can be made.

One ought to take many things into consideration before sending a patient alone to the Engadine. His strength, his purse, his courage, and social position. As to the latter quality, we may say, in passing, that the visitors at the best places in Upper St. Moritz are very companionable, as a rule, and are made up of the so-called better classes from England and America.

For a beginning case of consumption in a young man, we might expect that a long sea voyage, followed by a spring at Aiken, S. C., and a summer at St. Moritz, would be of the greatest benefit. Some others would do better to winter at Nassau (W. I.), and summer at St. Moritz. We believe that for *certain patients* the best European health resorts are far more likely to be beneficial than are the best in America. I refer, as a difference, to more agreeable ways of mental occupation and diversion. And this for some is a matter of no small moment.

CLIMATE OF SOUTHERN CALIFORNIA.

By H. S. ORME, M.D.,

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By climate we ordinarily mean the conditions of a place with reference to heat and moisture. To the physician, however, the term is much more comprehensive. It includes not only the question of heat and moisture, but a consideration of all the physical features that surround a locality, and which in any way affect it as a place of habitation. It embraces, therefore, in addition, the problems of topography, soil, water-supply, sanitary conditions, and social surroundings—everything, in fact, that is conducive either to sickness or to health.

In discussing the various natural phenomena which go to make up the climate of Southern California, we shall consider the following topics:

Position with reference to prevailing winds.
Topography.
Drainage and water-supply.
Soil.
Temperature.
Prevailing winds.
Humidity and rainfall.
Social surroundings.

Position with Reference to Prevailing Winds.

An inspection of a good physical map of the world will show that there are two great agents which transfer both heat and moisture from tropical to temperate latitudes, namely, winds and ocean currents. In the temperate zones the general direction both of the winds and the ocean currents, is from west to east. These currents start from moist tropical regions, and are diverted toward the higher latitudes of the temperate zones. Not only do they warm the land upon which they strike, by their higher temperature, but they also transfer a vast

amount of latent heat from tropical to temperate regions. These winds are loaded down with the moisture taken by evaporation from the tropical ocean, and when the moisture is precipitated on the western slopes of the continents all of the latent heat is set free, and is carried far inland.

It follows, then, that the western coasts of the continents receive a vastly greater amount of heat than do the eastern coasts situated in the same latitude of the temperate zones. Furthermore, this extra supply of heat is distributed in the winter season, at a time when it will be most appreciated. Thus we find that Sitka, Alaska, is about as warm in winter as the city of Washington, about eighteen degrees further south; while Labrador, situated in about the same latitude as Alaska, is an inhospitable region, shrouded in ice and snow during the greater part of the year. An equally striking case is the city of Los Angeles, which, situated seven degrees south of St. Paul, Minnesota, has a mean summer temperature six degrees lower. We may, therefore, expect to find on the western coasts of the temperate zones not only warmer winters, but cooler summers, than in places of corresponding latitude situated inland, or on eastern coasts.

Climatic Position of California.

The position of California is such that it receives the full benefit of all those conditions favorable to a mild oceanic climate. It faces the warm and moist winds of the Pacific both in winter and summer. The warm waters of the Kuro Siwo are swept down the coast, bathing the shores with water that is rarely cooler than 60°, nor warmer than 70°.

This State has a coast line which, including San Francisco Bay and its inlets, is nearly one thousand miles in length. Its most western point is in longitude 124° 30′; its northern boundary is the forty-second parallel. It extends through about ten degrees each of latitude and longitude. Two ranges of mountains traverse the State from northwest to southwest. The more westerly of these, the Coast Range, consists of several low and parallel ranges of mountains or hills lying next to the ocean, and giving contour to the coast. The easterly highland is the Sierra Nevada Mountains. This lofty range is the western rim of the immense highland basin—nearly one thousand miles in breadth—which separates the region commonly known as the "States" from the "Coast." This chain of mountains forms a lofty barrier which for nearly a thousand miles has no pass less than five thousand feet in

height, save where the Sacramento, Klamath, and Columbia rivers have worn their deep gorges through its rocky fastnesses.

To this stupendous mountain chain is due much of the genial influence of the climate which characterizes the Pacific coast. Its high crest, wrapped in a mantel of perpetual snow, wrests the moisture from the warm ocean winds, and turns it back in a thousand rills, rivulets, creeks, and mountain torrents, into the broad valley through which the San Joaquin and Sacramento rivers pour their flood.

Toward the southern part of the State the Coast Range of mountains turns sharply to the east and approaches the great chain of the Sierra Nevada. Near the northern boundary of Los Angeles County the Tehachapi Mountains rise abruptly from the San Joaquin Plain, and, extending nearly east and west, connect the two mountain chains which give to California its contour and outline. South of the crest of the Tehachapi Mountains lies the region commonly known as Southern California.

Topography.

The territory included under this name is, in itself, a totally distinct physical region. Its fauna and flora have much in common with that of the rest of California, but they also present many wide differences. Its topography changes; its climate is milder and moister, and its flora becomes more varied. The treeless plain of the San Joaquin, with its everlasting border of willows and tule swamps, gives place to palms and yuccas. The micaceous sediment which is the prevailing soil of Central California, changes abruptly to the gravelly loam of Southern California—in fact, there would be no greater change if one at a single step should clear six or eight degrees of latitude. North of the Tehachapi summit, climate, verdure, and products are those of temperate regions; south of this crest they are semi-tropical.

Politically Southern California consists of the counties of Santa Barbara, Ventura, San Bernardino, Los Angeles, and San Diego. They form an irregular rhombus or lozenge in shape, extending from latitude 32° 30′ to 35° 40′. The coast line has a southeasterly trend, and, including its indentations, has a sweep of about three hundred and thirty miles. Much of the coast of Los Angeles County, and nearly all of Santa Barbara County, presents a southerly exposure. Four of the five counties border on the sea—one only, San Bernardino County, is wholly inland.

The western part of this region is traversed by the Coast Range and its outlying spurs. They inclose a number of beautiful valleys, with

soil of wonderful fertility. Some of them are settled; all of them are capable of supporting a dense population. The elevation of this region varies from the sea level to 11,800 feet.

The eastern part is situated in the physical region known as the Great Basin. The crest of the Sierra Nevada Mountains divides its waters from those of the Pacific Slope. Some of its ephemeral streams reach the Colorado River, and, during a cloud burst, pour a torrent of water into its turbulent flood. For the greater part, however, none of these streams ever reach tide-water. They flow into "sinks," or spread out upon the desert until their waters evaporate under a burning, tropical sun. This region is commonly known as the Mojave Desert; a small area in the southern part, separated from the former by a low and isolated ridge, is called the Colorado Desert. The greater part of this desert region has an altitude of from one thousand to three thousand feet above the sea. There are, however, several remarkable depressions. Two of them, Death Valley, or the Arroyo del Muerto, and the Sink of the San Felipe, are about four hundred feet below the level of the ocean.

The trains of the Southern Pacific Railway, after climbing over San Gorganio Pass, descend into it, and cross the latter depression at a grade of two hundred and sixty-one feet below the sea. This vast depression, once an arm of the Gulf of California, was separated from the sea by the same process of ponding that separated the Caspian Sea from the ocean, and made it an inland lake. Its dry bed is covered with incrustations of gypsum, borax, and salt, which remained when the lagoon became a dry bed.[1]

But by far the most important part of Southern Calfornia is the western slope of the Coast Range, together with the multitude of valleys, great and small, which lie between the ridges of this system of mountains. This area begins as a narrow strip in the north, and widens to a vast plain in the south. Opening into it on the north is the San Fernando Valley; on the east the San Gabriel Valley extends more than sixty miles inland to the rim of the great basin. On the south the Santa Ana and San Joaquin Plains constitute an almost level plain, more than five thousand square miles in area.

This territory comprises an area which, in years to come, will be the most densely settled agricultural region on the Pacific coast. Its soil is unsurpassed in fertility; its climate is more genial than that of

[1] At the present time the New Liverpool Salt Company is reaping a rich harvest by collecting and refining the salt which collected in this lagoon before it was entirely cut off from the sea.

Southern Europe; its productive qualities are equal to those of the famous valley of the Po, which it closely resembles. It will produce almost any crop that can be grown between the Red River of the north and Key West. Even now its hoard of grain is consumed by the overcrowded population of London, while its canned fruits command a premium in the cities of Italy.

Drainage and Water-supply.

The drainage slopes of Southern California are two in number. Those whose sources are west of the rim of the Great Basin are insignificant in size, and are dry washes for the greater part of the year. Occasionally there will be a cloud-burst, and for a few hours these streams will be roaring torrents. There is a single rush of water, and then a bed of dry, white, burning sand indicates merely that water has been there some time or other.

On the western slope there are a multitude of short streams rising in the snows of the high mountain peaks, or fed by winter rains. Every cañon in the mountains is the bed of one of these streams which threads its way to the widening of the valley, where, joining other streams, the combined waters flow oceanward. But few of them reach the sea, however, for the cupidity of man diverts their waters into a thousand channels, and the coarse gravelly soil absorbs the last drop of their flood. But the greater supply of water is derived not directly from the rivers themselves, but from the vast amount of water which, absorbed by the porous sandstone, and the loose soil, forms a subterranean reservoir of water, underlying the greater part of the whole level region.

Anywhere in this plain water may be reached at a depth varying from twenty to one hundred feet. Thousands of artesian wells have been sunk through the pervious soil, and with scarcely an exception, a never-failing supply of water has been reached. In a minority of instances, the water spouts several feet above the surface. More frequently it must be raised to the surface by pumping. The quality of the water thus obtained is excellent. The mineral substances present are chiefly salts of potassium and sodium; the degree of hardness is below that of the average potable water. The smaller towns are usually supplied with water from this source. The larger centres of population more commonly depend on some one or more mountain streams which are piped from their sources and thus conveyed to cemented reservoirs. With the possible exception of the Croton water of New

York City, the water-supply of Southern California is equal to that of eastern cities.

Soil.

The character of the soil of any region depends mainly on the character of the geological formation of the country. In the Coast Range, and its outlying spurs, the rocks are chiefly sedimentary, and the soil therefore generally consists of the detritus coarsely pulverized. In their bearing on the climate the many varieties of soil may be classified with respect to their retentiveness of moisture.

The non-retentive soils comprise the clays, of which the area is comparatively small. The most common soil of this character is the well-known *adobe*, which occurs in patches varying from a few acres to several square miles in extent. It is of inferior specific gravity, contains a large amount of organic matter, and when mixed with water, swells into an extremely viscous mass. Exposed to the air, under the rays of a hot sun, the clayey soils, and especially the adobe, bake to a dry and friable mass. The adobe shrinking in bulk as it loses its moisture, breaks into small lumps, which are almost as hard as rock. The soils of this character are always rich in alkaline salts. They often contain such notable qualities that, with the drying out of the soil at the approach of summer, the ground is covered with a thick, white efflorescence of alkaline carbonates, mixed with magnesium sulphate.

The retentive soils comprise the sand belt along the coast, the gravelly loams, the vast plains of sedimentary deposit, and the so-called sandbottoms, formed by the overflow of the streams during the rains. Owing to their capillarity the soils of this class are moist throughout the year, even during the hottest and dryest weather. The secret of their moisture is not hard to find. They are permeated by the substratum of water that underlies the entire plain, and the hottest summer temperature does not cause evaporation to extend more than a few inches below the surface. So wonderfully productive are the sandy soils of this region that three crops of corn may in good season be grown and matured in one year.

The soil of the eastern section, or the arid region known as the Colorado Desert, also the river bottoms of the western slopes, are also classed among the sandy soils. Of real sand, however, there is none. The substance of this detritus is nothing more or less than finely pulverized granite, rich in feldspar and mineral phosphates. Soil of this character cannot be surpassed for the production of fruits, as the rich

flavor of the grapes grown in the bottom lands about Anaheim and Orange will attest.

Rainfall.

The benefits to be derived from the rainfall depend not so much on the quantity of precipitation as its distribution. A knowledge of the latter reveals much concerning the climatic conditions of a country.

The rainfall of the whole Pacific slope of North America occurs almost wholly during the winter months. The quantity of precipitation varies from about one hundred and twenty inches in Alaska, to about ten inches in San Diego. In Southern California there are a few scattering showers in November and December, but the heavier fall occurs in the three months following. There are occasional showers in April, and rarely in May. In the mountains, however, there are dashes of rain as late as the middle of June. On an average there are from twenty to thirty rainy days in the year. The rainy season of winter means—not a continuous overcast sky with constant precipitations, but—occasional rain storms lasting two or three days each, with long intervals of pleasant sunshine between.[1]

In the following table the stations are widely scattered over the northern and southern coast and inland limits of Southern California.

Station.	Position.	Average rainfall.
Santa Barbara,	Northern Coast	16.92
Los Angeles,	Sixteen miles inland	17.95
San Bernardino,	Sixty miles inland	16.35
San Diego,	Southern Coast	10.82
Fort Yuma,[2]	Colorado Desert	2.1

From the foregoing, it will be seen that the western slope receives an average of about sixteen inches of rain per year, while in the arid region the rainfall is insignificant, and as previously mentioned, comes usually in the form of cloud-bursts.

In the arid region wherever water can be obtained for irrigation, vegetation grows with the greatest luxuriance, as may be seen in the case of the railway station at Indio, on the Southern Pacific Railway. Without irrigation, the vegetation of this region is confined to the cactus and agave families, which are here more profusely represented than in any other part of the world.

In general the western slope of Southern California receives about

[1] In Los Angeles, during the year 1884, there were 316 clear or fair, and 50 rainy or cloudy days.

[2] Fort Yuma, formerly a U. S. Military Station, is in California. Yuma City is just across the Colorado River in Arizona.

as much rain as the Lower Sacramento Valley, considerably less than the western slope of Northern California, and a little more than the San Joaquin Valley. In the fruit-growing region the rainfall is sufficient for all purposes. In the grain-growing districts it is sufficient to produce as much as the soil will stand without wearing out—enough, on the average to mature six crops out of seven.

Relative Humidity.

By the relative humidity of the atmosphere is meant the amount of the vapor of water that the air can contain at a given temperature. Warm air, bulk for bulk, contains much more moisture than cold air. The air to-day which seems damp may to-morrow be dry,[1] and at the same time contain the same amount of moisture. In expressing, therefore, the humidity of a locality the figures usually show, not the weight of the aqueous vapor, but the percentage of the amount required to saturate it completely with moisture. Thus the percentage of sixty means that the atmosphere contains three-fifths of the amount that it is capable of holding. With a relative humidity of thirty-five, which is an average for the summer months at Fort Yuma, the air is exceedingly dry. With a percentage of seventy-three, which fairly represents San Francisco during the winter months, the air is damp, and in cold weather the wind, if it be blowing, has that quality commonly known as chilling. In warm weather it is not oppressive, but it lacks the invigorating qualities which a stiff breeze of mountain air imparts to the system.

On the coast the percentage of humidity varies from sixty-nine to seventy-five during the winter months, and sixty to sixty-eight in summer. Twenty miles inland there is a remarkable decrease in the humidity, and at a distance of one hundred miles inland, the atmosphere becomes very dry, the percentage varying from thirty to fifty.

From the time the first rains fall the belt of country next to the coast is bathed by a tolerably moist atmosphere. At a distance of a few miles inland is a narrow belt in which, owing to lower temperature at night, and also to the great amount of marsh lands, the humidity is somewhat greater. Here heavy fogs prevail, and the deposition of dew is enormous. Beyond this narrow strip the humidity rapidly decreases. After the rains are well over, the dew-fall gradually ceases, and the air becomes uniformly dry. One may camp out of doors, sleeping on

[1] Sacramento figures 19.7 inches; San Francisco 24.11 inches; Stockton 16.7 inches; Visalia 9 inches.

the ground, without danger to the health. There is no decomposition of organic matter, because there are no summer rains. The atmosphere becomes so free from the organic germs of putrefaction that meat cures or "jerks." It dries up, but does not putrefy, and the culture fluids used in cultivating the various species of bacilli and bacteria often remain weeks before breaking down.

This happy condition, however, is not universal. In the low bottom lands, and in localities where irrigation is practised, the air is quite as full of germs as any other locality. In such places the malaria is quite as effective and destructive to health as in the bottom lands of the Mississippi River. But such localities are rare, and may be readily avoided.

The most unpleasant features of the change of season are the fogs. Foggy nights and mornings occur on the average twenty to thirty times during the year. The fog rolls in from the sea through the natural passes and valleys in a manner that menaces a rain storm. It never reaches a thousand feet in height, however, and at a short distance from the coast it is unknown. Like the malarial spots, the fogs may be avoided.

Winds.

The prevailing winds of the southern coast have the nature of monsoons. The prevailing direction during the summer months is from the north and northwest; in winter from the south and southwest. The direction and strength of the wind are greatly modified by the proximity of the land, however; and as a general rule, local winds assert themselves all over the State.

From Point Conception southward they are especially noticeable, and in this region their cause can be easily explained. During the summer the land in the interior becomes greatly heated, creating a strong up-draught of air. As a result, there is a stiff sea breeze all along the coast, which is apparent to a distance of fifteen to twenty miles inland. It would appear from this that an extremely hot day inland would indicate moderately cool weather along the coast belt—a theory which, moreover, is in perfect accordance with the facts of the case.

Among the local winds of the Pacific coast is one variously known on the north coast as the Chinook, or in the south as the "Norther." In Southern California it is best known as the Santa Ana. It is a hot wind, extremely disagreeable during its prevalence, but is none the less valuable for its health-giving qualities. It is most usually confined to localities of limited extent, but occasionally it sweeps over an area of

several thousand square miles. During its progress the air becomes highly electrified. Horses' tails stick out like thick bushes. The hair of the head crackles sharply when stroked by the hand. Metallic objects resting on an insulating surface, such as dry wood, become condensers and collectors of the electrical fluid, and discharge themselves with visible sparks whenever a conductor is brought near. In one instance the telegraph line between Los Angeles and Tucson, more than four hundred miles long, was detached from the battery, and operated by the earth current alone.

Sometimes the Santa Ana wind is so hot and dry that the leaves wither and fall from the trees. This, however, is of extremely rare occurrence, and in general this wind lasts but a few hours. The pure, invigorating quality of the atmosphere, following the Santa Ana wind, more than counterbalances its disagreeable effects.

Temperature.

The mild temperature of California, as a whole, is due chiefly to its position with reference to the prevailing ocean winds. In Southern California an additional cause may be found in the low latitude. Lying in the same latitude as South Carolina and Georgia, a mild climate would be the natural result. But the fact that this region is swept by ocean winds gives it a climate which is typically an oceanic climate. This is the secret of its uniformity; it is hardly necessary to add that the temperature is most uniform nearest the ocean, and that the daily rains increase as one leaves the coast and travels toward the interior. This uniformity is shown on comparing the twelve hottest and the twelve coldest days of Santa Barbara during 1886. An average of the former is 71.3°; of the latter 47.6°. The highest reading for the year 1886 was 85°; the lowest 35°. The result would not differ materially had any other town near the coast been taken as an example.

By comparing the mean temperature of several localities widely separated we may be able to judge of the climatic features of Southern California so far as temperature is concerned.

Station.	Location.	June, July, Aug.	Dec. Jan. Feb.
Santa Barbara,	North Coast . .	. 65.5°	56.8°
Los Angeles,	Sixteen miles inland	. 66.1	50.0
San Diego,	South Coast . .	. 66.3	53.1
San Bernardino,	Sixty miles inland .	. 69.0	49.0
Fort Yuma,	Colorado Desert .	. 87.1	54.8

A much wider and more interesting comparison is shown in the following table, taken from a physical geography recently published by E. H. Butler & Co., Philadelphia. In this table are shown the comparative summer and winter means of all the principal cities and climatic centres in the United States.

Station.	Locality.	Latitude.	Aver. temp. of June, July, Aug.	Aver. temp. of Dec. Jan. Feb.	Average rainfall in inches.
Sitka, Alaska,	Pacific Slope	57° 03′	54°	35°	102.3
Olympia, W. T.	Pacific Slope	47 02	59	37	69.0
Pembina, Dakota,	Red River Valley	49 00	64	5	21.1
Duluth, Minn.	Lake Region	46 48	65	15	33.4
Portland, O.	Pacific Slope	45 30	65	40	53.5
St. Paul, Minn.	Mississippi Valley	40 53	71	18	29 06
Eastport, Me.	Atlantic Slope	44 55	58	25	48.6
Milwaukee, Wis.	Lake Region	43 03	66	28	34.6
Buffalo, N. Y.	Lake Region	42 53	68	32	37.1
Boston, Mass.	Atlantic Slope	42 23	68	32	50.8
Salt Lake, U. T.	Great Basin	41 10	74	27	18.9
Chicago, Ill.	Lake Region	41 52	73	31	35.3
New York,	Atlantic Slope	40 42	72	37	43.3
Sacramento, Cal.	Pacific Slope	38 35	73	44	22.9
Denver, Col.	Rocky Mountains	39 45	71	39	15 4
Cincinnati, O.	Mississippi Valley	39 06	77	44	42.4
Philadelphia,	Atlantic Slope	39 52	73	36	41.2
Washington, D. C.	Atlantic Slope	38 53	76	42	42.8
San Francisco, Cal.	Pacific Slope	37 47	58	48	23.2
Louisville, Ky.	Mississippi Valley	38 18	77	46	48.4
Lynchburg, Va.	Atlantic Slope	37 30	77	45	41.8
Los Angeles, Cal.	Pacific Slope	34 03	65	50	17 1
Atlanta, Ga.	Gulf Slope	33 45	77	52	50 3
Yuma, A. T.	Colorado Basin	32 43	88	53	2.7
Vicksburg, Miss.	Mississippi Valley	32 23	80	56	56.7
Savannah, Ga.	Atlantic Slope	32 05	82	58	55.2
San Antonio, Texas,	Gulf Slope	29 28	85	59	31.2
New Orleans, La.	Gulf Slope	29 58	82	61	65.5
Key West, Fl.	Ex. U. S.	24 32	84	73	39.7

At Los Angeles, during the year 1880, the thermometer was as high as 90° only fourteen times. The highest temperature ever recorded at this station is 103° ; the lowest 28°. At San Diego the highest ever recorded is 101° ; the lowest 32°. Across the divide in the Colorado Desert, however, the heat of summer becomes exceedingly great. A temperature of 120°, or more, lasting for weeks, is no uncommon thing in this region. A temperature of 135° has been recorded at a station on the old southern mail stage road, between Acampo and Yuma. At Yuma, during the year 1880, the temperature exceeded 100° in one hundred and eighteen days, and in twenty-eight of these the mercury rose to 110° and higher.

Although such high temperatures would probably strike one as being unendurable, the contrary is really the case. One may be out of doors in this region when the thermometer stands at 120° with much

more safety than in Chicago or New York with the temperature twenty degrees lower. That this assertion is well founded may be shown from the fact that people who live here go about unconcernedly with a temperature which in a region of summer rains would soon cause its depopulation by sunstroke. Throughout this entire region sunstroke is almost entirely unknown, and the immunity from it depends, not from vigorous health or hardy development, but from the fact that the air is excessively dry.

On the Pacific Slope of Southern California frosts are of rare occurrence. The localities which they are most apt to visit are the low bottom lands along the water courses, the swampy regions, and the high mountain altitudes. They are of greater frequency thirty or forty miles inland than nearer to the coast. There are, however, extensive areas where they never occur at all. Tropical fruits may suffer from other causes, but not from cold.

A word or two concerning clothing may not be amiss in this connection. Although the days of the summer season may be blistering hot, the nights are invariably cool, and the moral to be drawn from this is obvious. No matter what may be the dress for daytime, those going about in the evening require heavy undergarments all the year round. People who have lived here long enough to be judges are almost unanimous in declaring that flannels should always be worn next to the skin. Linen and cotton outer-garments are worn to a much less extent here than in New York, Boston, or Chicago. There are not half a dozen days in the year when a light woollen suit will be uncomfortable; there are many days during the summer season when the temperature demands it. Among the old residents the chief difference between summer and winter dress is a somewhat heavier suit of underwear for the winter season.

The foregoing remarks on temperature point conclusively to one fact which it is well to emphasize particularly: that is, the desirability of Southern California as a summer resort. That this region offers special inducements for winter residents is generally admitted as a matter of fact; however, in nine cases out of ten, more benefit will be derived from the dry salubrious air of the summer months than from the climate of the winter season. During the warm season there is no place, except the immediate coast, where persons of the feeblest constitution cannot camp, or live out of doors for six or seven months in a year, and that with impunity.

It is no uncommon thing for parties to go camping in the mountains, to the mines, to the beach, or to the various mineral springs in which

the country abounds. They eat, live, and sleep, on the ground, enjoying in the meantime the nomadic life, the luxury of which no one can appreciate who has not tasted.

There may be some inconveniences about such living, but for danger to health not the slightest. And the secret is not warm temperature, but *pure, dry air*, which, after all, is a more effective panacea than was ever put up in the shape of physicians' prescriptions.

Social Surroundings.

Whatever may be said of the commercial importance of Southern California, or its future as a great centre of industry, of wealth, and of population, its importance as a sanitary resort cannot be overestimated. Its winters are far milder than those of Florence or Naples, and its summer breezes are not filled with the miasmatic exhalations of the Campagna. More than this, the sufferer who comes here is surrounded, not by a foreign people whose every question is repulsive, but by people of refinement and education, who represent the best social and intellectual conditions to be found anywhere in the United States. Within a radius of one hundred miles are a dozen towns with population varying from three thousand to fifty thousand.

Los Angeles, the commercial centre of this region, is not surpassed by any city in the United States in respect to the conveniences and necessities required either by invalids or by persons of robust health. Five lines of steam railways radiate east, west, north, and south. Cable street cars, electric motors, are laid in the principal thoroughfares, and for three hundred and sixty-five nights in the year the whole city is lighted by electricity. The educational facilities of Southern California are equal to those of any part of the coast, being supplied with every grade of kindergarten, intermediate, grammar, and high schools; and at the head of these stands the University of California with its various colleges and its medical school.

"Within this radius one may find spots four hundred feet below the sea level, or ten thousand feet above it. Spots that have nightly a fog, and localities that never know the presence of a fog; places swept by an almost constant breeze, and others perpetually sheltered from all wind; the odors and gases from petroleum springs, or the air of the mountain pineries; the scent of orange blossoms, or the balsamic odor of the desert. Differences of elevation that elsewhere one may travel a thousand miles to find, here are found within a radius of fifty miles."

THE CLASSIFICATION OF AMERICAN MINERAL WATERS.

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Possibly a more correct title for my paper would be "The Classification of the Mineral Waters of the United States," but if the scheme holds good for the mineral waters of our own country, there is no reason why it should not apply to all mineral waters, whether Asiatic, European, or American.

For the last three years I have collected the statistics of the production of the mineral waters of the United States, for publication in the volumes on the mineral resources of the United States, published annually by the Geological Survey.

In the course of this work I have compiled the analyses of nearly 800 of our mineral waters. These analyses, with lists of the springs and other data relating to them, have been tabulated and published in Bulletin 32 of the U. S. Geological Survey.

It occurred to me that in this material might be found the data for a more complete classification of American mineral waters than has yet been made; and with this idea in view, I have attempted a scheme of classification which seems to me at once simpler, more logical, and better adapted to the conditions presented than most of those previously outlined.

I take it that there is no necessity to advocate the desirability of some systematic arrangement of our mineral waters. It lies at the very foundation of any study of the subject, no matter what may be our point of view. Any classification will be to a certain extent arbitrary, for many of the waters shade into each other in respect to their ingredients, and the question is, What kind of a classification shall we adopt? It may be made from a geographic, a geologic, a therapeutic, or a chemic standpoint.

The latter two, of course, are the ones of particular interest to the medical practitioner.

A therapeutic classification of our mineral waters is out of the question at present, and probably will be for a long time, as there are few, if any, of the springs whose waters have been so thoroughly studied in a clinical way that we have intelligent and accurate knowledge of their effects upon correctly diagnosticated diseases. We are, therefore, reduced to a chemical classification based upon the predominance of one or more of the ingredients.

In the absence of complete therapeutic data we can rely with a reasonable degree of certainty upon the chemical composition, and may expect certain effects from the probable combinations indicated by the analysis, especially as we have the benefit of experience derived from the study of well-known springs in Europe, where the subject has been accorded a prominence which it will no doubt have eventually in this country. Before that day arrives, our spring owners as a class will have to be more willing to subject themselves to scientific restrictions, and the people who use the water will have to learn to regard the watering places as something more than merely places of recreation. We certainly have many valuable springs which need only development to have attention called to their therapeutic importance.

This is not the place, nor have I the time to treat of the historical aspect of the subject. It will be found detailed in any treatise on the subject of mineral waters. I simply give one of the oldest classifications for the sake of comparison. Pliny divided water as follows: Nitrous, Aluminous, Bituminous, Salt, Sulphurous, Acidulous, Martial or ferruginous, Salubrious, Poisonous; such as boil, pulse slowly, such as incrust the vessels in which they are placed, such as intoxicate, etc.

The numerous schemes found in the books of to-day do not differ materially from this classification of Pliny. The majority of them can be reduced to the following list—some containing all, others only a part: Indifferent or chemically indifferent, Acidulous or carbonated, Alkaline, Calcic or calcareous, Saline, Purgative or aperient saline, Chalybeate, Sulphurous or sulphuretted, and Thermal.

The classification made by Walton, in his *Mineral Springs of the United States and Canada*, is given below with the German and French systems as quoted by him.

Walton's Classification.

I. Alkaline waters	1. Pure. 2. Acidulous. (Carbonic acid.) 3. Muriated. (Chloride of sodium.)
II. Saline waters . . . . . (Chloride of sodium)	1. Pure. 2. Alkaline. 3 Iodo-bromated.

III. Sulphur waters	1. Alkaline. 2. Saline. (Chloride of sodium.) 3. Calcic.
IV. Chalybeate waters	1. Pure. 2. Alkaline. 3. Saline. (Chloride of sodium) 4. Calcic. 5. Aluminous.
V. Purgative waters	1. Epsom salt. (Sulphate of magnesia.) 2. Glauber salt. (Sulphate of soda.) 3. Alkaline.
VI. Calcic waters	1. Limestone. (Carbonate of lime.) 2. Gypsum. (Sulphate of lime.)
VII. Thermal waters	1. Pure. 2. Alkaline. 3. Saline. (Chloride of sodium.) 4. Sulphur 5. Calcic.

German Classification.

I. Alkaline	1. Simple carbonated. 2. Alkaline. 3. Alkali and common salt.
II. Glauber salt.	
III. Iron	1. Pure. 2. Alkaline and saline. 3. Earthy and saline.
IV. Common salt	1. Simple. 2. Concentrated. 3. With bromine and iodine.
V. Epsom salt.	
VI. Sulphur.	
VII. Earthy and calcareous.	
VIII. Indifferent.	

French Classification.

Sulphur waters	With salts of sodium. With salts of lime.
Chloride of sodium waters	Simple. With bicarbonates. Sulphuretted.
Bicarbonated waters	Bicarbonate of soda. Bicarbonate of lime. Mixed bicarbonates.
Sulphated waters	Sulphate of soda. Sulphate of lime. Sulphate of magnesia. Mixed sulphates.
Ferruginous waters	Bicarbonated. Sulphated. With salts of manganese.

My first objection to Walton's scheme holds against many others, viz., that it is a mixture—he combines three systems in one. The term thermal is based on a physical sensation, purgative refers to a therapeutic action, and the other terms are based on chemical composition.

Again, in all three of these classifications, even so far as a chemical system is followed, the terms are based on properties that are not analogous.

The terms denoting the presence of gaseous constituents are made equivalent to those based on the character of the solid constituents. Sulphur waters are those characterized by the presence of sulphuretted hydrogen gas; carbonated or bicarbonated waters are so named from the presence of free carbonic acid gas, while the terms alkaline and saline refer to the presence of certain solid constituents. In the German classification, under the head of common salt waters, we find a division corresponding in part to the amount of sodium chloride contained in them, a difference in degree which can be shown just as well by arranging the waters according to the amount of salt held in solution, beginning with the weakest. This brings me to the scheme of classification which I wish to present here.

In the first place, all waters are characterized by their temperature. They are cold, tepid, warm, or hot. They are therefore divided into two great groups—non-thermal and thermal. I do not here use the term thermal as applying to springs whose temperature is above the mean annual temperature of the place in which they are located, but include under the designation those which have a temperature of 70° F. or more. A thermal spring may belong to any one of the classes or divisions which are based on the predominating solid constituents. The fact that a spring is thermal depends upon its geologic position. Warm and hot springs are found in regions of volcanic rocks, in connection with faulted or dislocated strata, in areas of mountain corrugation, or where borings have been made to great depths below the surface. It has frequently been stated that thermal springs are less highly mineralized than others, but I find no facts to sustain this statement. They are less numerous, but there appears to be no reason why they may not duplicate non-thermal springs in every particular except temperature. I next divide each group of waters into four classes, viz., alkaline, alkaline-saline, saline, and acid.

In the first place, the term indifferent or chemically-indifferent is not included. The question as to whether a water should be called indifferent or not, is one upon which it would be difficult to secure a unanimous opinion. The spring owner would perhaps draw his line at one place, the physician who prescribes the water might draw it at another, and the chemist at still a third place. I would therefore arrange the analyses in order, according to the proportion of the classifying ingredient, beginning with the least highly mineralized water under each division, and I prefer that the lines of indifference be drawn

by those especially interested. Pure water is a product of the chemical laboratory alone.

In the second place, there are no chalybeates placed on a line with the alkaline or with the saline springs. Of course, all iron waters are tonic in their effects, but they may differ widely in other properties. When we compare the various analyses of chalybeate springs, we find that those in which the iron exists as a carbonate, contain also carbonates of the alkalies or alkaline earths. Others contain iron sulphates with various other sulphates, or they may be characterized by chlorides. Others, again, have free acid with the saline constituents.

The chalybeates, therefore, it seems to me, should be divisions of the alkaline, alkaline-saline, saline, and acid classes, and here they are placed in my scheme. The fact that all contain iron should not relegate them to one class, especially when their effects are widely different. I do not think we can ignore the other ingredients.

Almost the same remarks hold good for the sulphur springs that have been made in regard to the chalybeate springs.

Sulphur springs are those in which free sulphuretted hydrogen exists —that is, they have a gaseous constituent. A very little sulphuretted hydrogen will go a great way in classifying a spring, but I see no more reason why we should disregard the solid constituents here, than in the case of the chalybeates. Even the chalybeates may be sulphuretted, and in fact any division of the four classes that I have outlined may contain the same gaseous constituent. The waters are therefore characterized finally according to the gas they contain. They may be non-gaseous, carbonated, sulphuretted, carburetted, or azotized (that is, with nitrogen gas). It may be objected that the sulphur springs are separated, but if necessary the scheme can be reversed and the gaseous character indicated first. If this is done, the alkaline, saline, and acid springs must be separated.

The plan I have adopted appears to me to be more compact. It is preferable to keep all the alkaline waters together, all the saline waters together, etc., particularly as the analyses are not nearly so complete with reference to the gaseous constituents, as to the solid constituents. Many waters lose the gases long before the water is analyzed in the laboratory.

It is possible that many of the non-gaseous springs of my lists may have to be transferred to the other divisions when we have more complete analytical data.

There is a fashion in mineral waters as in most other things. Sulpho-carbonated waters promise to come to the front in the near future, and at the present time lithia waters occupy a prominent place.

I know of but one lithia water, however, in which the analysis shows enough lithia proportionally, to entitle it to a distinct and separate place on my scheme of classification: that one is from the Londonderry Lithia Spring of New Hampshire, which is said to contain over 13 grains of lithium carbonate, out of 30 grains of solids to the gallon. In the others the amount is relatively small, and very frequently consists only of traces, so that the springs are classified by some other ingredient. However, the fact that the water contains lithia, even if only a trace, will probably be expressed in the name given to the spring. In making these remarks, of course I say nothing as to the efficacy or non-efficacy of even the traces in some of the springs. It is not my province here either to deny or affirm. What is true of the lithia waters is true of many others in which certain ingredients exist in small quantities—ingredients which are supposed to be particularly efficacious in certain diseases. In no scheme of classification can we take account of all the minor constituents. It is impossible to express all the shades of difference, and in the examination of the analysis with a view to the use of the water a process of exclusion or elimination will have to be followed in order to get at the water just suited to the peculiar conditions presented.

Returning now to the scheme I have outlined: my first class is alkaline. This name has been so long and universally used to include those waters that contain the alkaline carbonates, that I have retained it. I include under it all water characterized by carbonates, whether of the alkalies, alkaline earths, the alkaline metals, or even iron alone. As already noted, the carbonate of iron is usually associated with alkaline carbonates.

The alkaline waters as thus designated are divided primarily into five great divisions, viz.: sodic, potassic, calcic, magnesic, and chalybeate, in which the carbonates of sodium, potassium, calcium, magnesium and iron, respectively predominate. I have also separated those springs in which there is a combination of calcic-chalybeate, sodic-magnesic, etc. Now each of these divisions may be non-gaseous, carbonated, sulphuretted, etc., or there may be a combination of two or more of the gases, as sulpho-carbonated, etc. Some few springs contain a large quantity of free nitrogen gas. These I have designated as azotized. In others the predominating gas is carburetted hydrogen—that is, they are carburetted. For those springs characterized by free carbonic acid gas, I have used the term carbonated instead of acidulous, in order to avoid confusion when considering the acid springs. We find that there are carbonated acid sulphated springs—*i. e.*, springs

with free sulphuric acid, sulphates, and free carbonic acid gas, and to call these springs acidulous acid springs, would be, to say the least, somewhat awkward.

Nearly one-half of the alkaline springs are calcic-alkaline—that is, with calcium carbonate, or bicarbonate, predominating. The calcic-chalybeate springs come next in number. I cannot enumerate all the alkaline springs here, but simply say that they have been separated according to the scheme just outlined. Under the head of calcic-alkaline a great many of our well-known springs fall, such as the Waukesha springs of Wisconsin, the Poland spring and Auburn spring of Maine, the Gettysburg spring of Pennsylvania, etc. Under calcic-chalybeate we find some of the Bedford springs of Pennsylvania, and some of the springs near Crab Orchard, and other localities in Kentucky, and the iron spring at Richfield Springs, New York.

The next class I make includes the alkaline-saline springs, viz.: those in which there is a mixture of carbonates with sulphates or with chlorides. I divide it, therefore, into two divisions, sulphated and muriated, according to the predominance of either set of salts, and secondly, subdivide these exactly as I did the alkaline springs, according to the base, into the sodic, potassic, magnesic, chalybeate, etc. Each one of these sub-divisions may also be non-gaseous, carbonated, or sulphuretted, etc.

The most prominent springs under the head of alkaline-saline are the Saratoga springs, which I place under the head of carbonated sodic-muriated alkaline-saline springs—*i. e.*, they contain free carbonic acid gas, and have sodium chloride predominating, and contain also alkaline carbonates. The Clarendon springs of Vermont are also alkaline-saline, being carbonated calcic-magnesic. Of course, the sodic-muriated springs are the most numerous in this class. The third class—saline springs—is divided exactly as are the alkaline-saline springs. The salines outnumber the alkaline-salines in the proportion of three to one, and are nearly one-third more numerous than the alkaline springs. Almost all of the springs usually classed under the head of purgative or aperient saline will fall under the head of sulphated salines in my scheme. Thus a sodic-sulphated water and a magnesic-sulphated water would not be mistaken for anything else than purgative waters. Among other waters of this division are the well-known Crab Orchard and Harrodsburg springs of Kentucky, Anderson spring of Bedford Springs, Pennsylvania, the Midland Well of Michigan, and Alburgh springs of Vermont.

About one-quarter of the sulphated salines are calcic. Possibly in arranging these waters the proportions of the other sulphates ought also to be given, as the calcic sulphate is supposed to be inert, medici-

nally. Sharon Springs, New York, have been placed under the head of sulphuretted calcic-magnesic sulphated waters. Some of the Richfield springs belong here also. Possibly they should be called sulphocarbonated, although the sulphuretted hydrogen largely predominates. Under the chalybeate-sulphated springs a large number of the alum springs fall. Those with free sulphuric acid, however, belong to the next class. Of the muriated saline springs nearly eighty-eight per cent. are sodic-muriated—that is, with common salt as the principal constituent. Of course, all brines fall under this head.

The fourth and last class I have named acid, a class that has been neglected in most schemes of classification. Here under the sulphated acid division I place those waters characterized by the presence of free sulphuric acid, and sulphates. They include the sour springs found at three localities in Texas, the Oak Orchard acid springs of New York, the Blossburg springs of Pennsylvania, the Iowa acid springs, and most of the alum springs of Virginia and Kentucky.

The muriated acid springs are those characterized by the presence of free hydrochloric acid, in connection with chlorides. So far as the analyses show, we have no springs of this division within the limits of the United States. A number of such springs are found in the New Zealand Geyser regions, and further investigation may disclose their existence in our own geyser region, the Yellowstone National Park.

In the National Park we have most of the springs of my next division of acid springs, viz.: the silicious springs, in which silicic acid is present in considerable proportion. They are nearly all thermal. During the past few years Dr. Gooch, lately appointed Professor of Chemistry at Yale College, has been working on a series of analyses of the Yellowstone Park waters, and with the assistance of Mr. J. E. Whitfield in the Laboratory of the Geological Survey, has completed about forty analyses which will be of great interest to geologists, chemists, and physicians. They are of remarkable complexity. All the waters contain arsenic in quite an appreciable quantity. These analyses have not been published, but when they are we will have the data for the more complete subdivision of the silicious springs, which are in greater number in the Park than anywhere else in the country, and possibly they exceed those of any other geyser region in the world.

In conclusion, let me say that I think any spring that may hereafter be analyzed can be fitted into a place in the scheme I have outlined, and that the designation of a water in accordance with it, gives one, be he physician or layman, at once a definite and clear idea of its general composition. Under this scheme I have arranged between 600 and 700 waters according to the actual proportion of the classifying ingredients, and expect finally to arrange them according to percentages.

Scheme of Classification.

Group A. Non-thermal. *Group B. Thermal.*

- Class I. Alkaline.
- Class II. Alkaline-saline . . . .
  - 1. Sulphated.
  - 2. Muriated.
- Class III. Saline . . . . . .
  - 1. Sulphated.
  - 2. Muriated.
- Class IV. Acid . . . . . .
  - 1. Sulphated.
  - 2. Muriated.
  - 3. Silicious
    - a. Sulphated.
    - b. Muriated.

- I. Alkaline. . .
  - Sodic . . . . . .
    - Non-gaseous.
    - Carbonated.
    - Sulphuretted.
    - Sulpho-carbonated.
  - Lithic . . . . . .
    - *Carbonated.*
  - Potassic . . . . . .
    - *Non-gaseous.*
    - *Sulphuretted.*
  - Sodic-potassic . . . . . .
    - *Carbonated.*
  - Calcic . . . . . .
    - Non-gaseous.
    - Carbonated.
    - Sulphuretted.
    - *Sulpho-carbonated.*
    - *Carbonated-azotized.*
    - Azotized.
  - Sodic-calcic . . . . . .
    - Carbonated.
    - *Sulphuretted.*
  - Calcic-magnesic . . . . . .
    - Non-gaseous.
    - Carbonated.
    - *Sulphuretted.*
    - *Sulpho-azotized.*
  - Magnesic . . . . . .
    - *Non-gaseous.*
    - *Carbonated.*
    - *Sulphuretted.*
  - Chalybeate . . . . . .
    - *Non-gaseous.*
    - *Carbonated.*
    - *Sulphuretted.*
    - *Sulpho-carbonated.*
  - Sodic-chalybeate . . . . . .
    - *Carbonated.*
    - *Sulphuretted.*
    - *Sulpho-carbonated.*
  - Calcic-chalybeate . . . . . .
    - Non-gaseous.
    - *Carbonated.*
    - *Sulpho-carbonated.*
    - Sulphuretted.
  - Magnesic-chalybeate . . . . . .
    - *Carbonated.*
    - *Sulpho-carbonated.*
- II. Alkaline-saline
  - 1. Sulphated
    - Sodic . . . . . .
      - Non-gaseous.
      - *Carbonated.*
      - Sulphuretted.
    - Calcic . . . . . .
      - Non-gaseous.
      - *Carbonated.*
      - Sulphuretted.
      - *Sulpho-carbonated.*
    - Calcic-sodic . . . . . .
      - *Non-gaseous.*
      - *Carbonated.*
      - *Sulphuretted.*

II. Alkaline-saline	1. Sulphated	Sodic-magnesic	Non-gaseous. *Sulpho-carbonated.*
		Calcic-magnesic	*Carbonated.* *Sulpho-carbonated.* *Carburetted.*
		Calcic-chalybeate	*Carbonated.*
	2. Muriated	Sodic	Non-gaseous. Carbonated. Sulphuretted. *Sulpho-carbonated.*
		Calcic	*Non-gaseous.* *Sulphuretted.*
		Sodic-calcic	*Non-gaseous.* *Carbonated.*
		Sodic-magnesic	*Carbonated.*
		Calcic-magnesic	*Carbonated.*
		Sodic-chalybeate	*Non-gaseous.*
III. Saline	1. Sulphated	Sodic	Non-gaseous. Carbonated. Sulphuretted. *Sulpho-carbonated.*
		Potassic	*Non-gaseous.*
		Potassic-sodic	*Sulphuretted.*
		Calcic	Non-gaseous. Carbonated. Sulphuretted. *Sulpho-carbonated.*
		Sodic-calcic	*Non-gaseous.* *Sulphuretted.* *Sulpho-carbonated.*
		Sodic-calcic-magnesic	*Sulphuretted.* *Sulpho-carbonated.*
		Magnesic	*Non-gaseous.* *Carbonated.* *Sulphuretted.* *Sulpho-carbonated.*
		Sodic-magnesic	*Non-gaseous.* *Carbonated.*
		Calcic-magnesic	*Non-gaseous.* *Carbonated.* *Sulphuretted.* *Sulpho-carbonated.* *Carbonated-azotized.*
		Alumino-magnesic	*Non-gaseous.*
		Chalybeate	*Non-gaseous.* *Carbonated.* *Sulphuretted.*
		Sodic-chalybeate	*Carbonated.* *Sulphuretted.*
		Potassic chalybeate	*Carbonated.*
		Calcic-chalybeate	*Non-gaseous.* *Carbonated.* *Sulphuretted.* *Sulpho-carbonated.* *Carbonated-azotized.*
		Alumino-chalybeate	*Carbonated.*
		Calcic-alumino-chalybeate	*Non-gaseous.*
		Magnesic-chalybeate	*Non-gaseous.* *Carbonated.*

III. Saline	1. Sulp	Calcic-magnesic-chalybeate	*Non-gaseous.*
		Calcic-magnesic-alumino-chalybeate	*Non-gaseous.*
		Magnesic-sodic-chalybeate	*Non-gaseous.*
	2. Muriated	Sodic	Non-gaseous. Carbonated. Sulphuretted. Sulpho-carbonated. *Carburetted.* *Carbonated azotized.*
		Calcic	*Non-gaseous.*
		Calcic-sodic	Non-gaseous.
		Sodic-magnesic	Non-gaseous.
		Calcic-magnesic	*Non-gaseous.*
		Sodic-calcic-magnesic	*Carbonated.* *Sulphuretted.*
		Chalybeate	*Non-gaseous.*
		Calcic-chalybeate	*Carbonated.*
		Sodic-chalybeate	Non-gaseous.
		Sodic-magnesic-chalybeate	*Non-gaseous.*
IV Acid	1. Sulphated	Calcic-chalybeate	*Non-gaseous.*
		Alumino-chalybeate	*Non-gaseous.* *Carbonated.* *Sulphuretted.* *Sulpho-carbonated.*
		Alumino-magnesic-chalybeate	*Carbonated.*
		Calcic-alumino-chalybeate	*Non-gaseous.*
		Calcic-magnesic-chalybeate	*Non-gaseous.*
		Calcic-alumino-magnesic-chalybeate	*Non-gaseous.*
	2. Muriated		
	3. Silicious	*a.* Sulphated. Sodic	Non-gaseous.
		b. Muriated. Sodic	Non-gaseous.

In the scheme as outlined above, the divisions that have representatives among the non-thermal springs are printed in the last column, in *italics;* those that have thermal springs referable to them, in Roman letters: and where both groups are represented, a black faced letter is used.

THE MEDITERRANEAN OF THE UNITED STATES AS A RESORT FOR INVALIDS.

By CHARLES L. LE ROUX, M.D.,
OF PASS CHRISTIAN, MISS.

In spite of many excellent and valuable writings, there is perhaps no branch of medical science which has been so neglected as that of climatology. The laws of climate are so ill understood that hundreds of patients are sent away every winter merely to find a grave far from their home comforts, relations, and friends. And why does this state of things continue to obtain?

Among the profession there are too many, who, after exhausting all the resources of their art, look to a change of climate as a *dernier ressort*, hoping, even against hope, to effect a cure. Generally speaking, how easy it is to induce the laity to assume the same hope! We should seldom expect a cure from a change of climate, but rather improvement of a more or less decided and permanent nature. And when this improvement does not take place, is not one liable to attribute to the "propter hoc" that which should be referred to the "post hoc?"

It seems to me that we know too little as yet, concerning the advantages of different climates, at different seasons, to use so lavishly in connection with them the word *cure;* for the seasons themselves are subject to unexpected fluctuations. Who would be rash enough to boast of a model climate—a climate without any drawbacks or imperfections—a climate that would prove infallible for certain complaints? Where is that happy spot? Name it—name it quickly too! For consumption alone, without referring to any other disease, yearly claims a holocaust of victims equal to one-third the entire mortality of the United States. Name it quickly, for if any climate be curative, it is full time we should learn something positive about it. Name it, for to-morrow it may be too late!

But climate, methinks, is only a comparative term, and, generally speaking, perhaps not invariably so, it should be looked on as such. Of late years it has received a very extended application.

"By climate is now understood those conditions of heat, moisture, atmosphere, wind, soil, and electricity, which impress certain conditions, uniform, even when apparently irregular, on given portions of the earth's surface, and which modify, also in a uniform manner, vegetable and animal life."—Quain.

It is, therefore, of primary importance that a physician should be in some way thoroughly acquainted with the advantages and disadvantages of any given climate, before he induces his patient to leave the comforts of home; and he should consider it a matter of sacred duty to give thoroughly honest information to one whose life not seldom hangs by such a slender thread as that of a proper change. That this is too often neglected, we must confess to our sorrow, as we gather proof by the large number of victims returned home every winter from certain of our most famous health resorts. Each time we are told very complacently: "He came too late!" Hundreds, every season are returned in caskets from Colorado, California, Mexico, Florida, and other places. The latter State, in fact, has acquired the unenviable title of "Euthanasia," because so many are sent there to die a comfortable death. There was not, it is true, for most of these invalids the ghost of a chance for recovery when sent. But *n'importe!* the last and only hope was given them. And all this from a sad misconception as to the benefit to be derived from a change of climate!

It, therefore, seems very clear that before advising a patient to leave all that is dear to him, his physician should first make the following inquiries:

A. Is the invalid too far advanced in his disease to exclude all possibility of a cure by a change of climate?

B. Which will suit the case best—a warm, a temperate, or a cold climate?

C. Is the disease acute or chronic, or likely to become so?

D. What is the health status of the spot selected, and its death-rate per 1000?

E. What are the prevailing diseases?

F. What are the sanitary and atmospheric conditions of the place? Is it dry or damp?

G. What are the prevailing winds?

H. Is it liable to malaria?

K. What is the mean temperature at different seasons?

L. Is it liable to protracted, drizzly rains or to occasional refreshing showers?

M. How many days, on an average, can a patient lead an outdoor life without unnecessary exposure?

N. What is the social status of the inhabitants? Are they rough, uncleanly, uneducated, inhospitable, or otherwise?

O. Is the patient likely to secure proper fare and attention? How are the hotels and boarding-houses kept? Can private cottages be secured in case of need?

P. Is the resort in direct, easy communication with other parts of the country both by rail and by wire?

R. Are there any good physicians practising there?

It is clear that one's common sense ought to suffice to find adequate reasons in the proper answers to the above, why he should or not, select any given locality for his invalid friend, and each proper answer will contain a therapeutic fact or law which no person of ordinary intelligence and education will fail to recognize and properly apply in time of need.

During my late visit North I found, to my utter surprise, but three or four of my colleagues who seemed to know the location of my place of residence and practice. I mean the town of Pass Christian, Miss., and great, indeed, was their astonishment, when, in the course of conversation, I told them of its advantages as a summer and winter health resort—the latter especially.

All agreed it was my imperative duty to make it known as soon as possible to the profession, and on parting with them, they made me promise that I would write an article on the subject.

It is my apology for taking up my pen on this day, knowing full well how many others could handle it to better advantage, and do greater justice to the subject. In doing so, I will positively give a simple, but fair *résumé* of the advantages of our seacoast as a resort for invalids, and will feel sufficiently rewarded for my labor, if these lines should induce my colleagues to give this resort the test which it deserves over many others, and which, after being extolled to the skies, enjoyed but a temporary popularity, because not founded upon the proper basis—truthful facts.

If one will take the trouble to examine the little map I append to this article, he will notice that the Gulf Coast, which lies between the cities of Mobile and New Orleans, forms a crescent, in the centre of which lies the town of Pass Christian. At a distance from shore varying between five and eight miles, a belt of islands forms a protective bulwark against the occasional storms that may prevail in the Gulf, making the body of water between the islands and the main shore a

sort of inland lake, elliptical in shape, and rarely disturbed beyond a ripple.

These waters abound all the year round in fish and oysters, and offer to many the pleasures of yachting, rowing, and fishing. Time does not permit me to give a description of the advantages of each place on this coast. The distance by rail between Mobile and New Orleans is about one hundred and forty miles, and there are from twelve to fifteen villages stretched along the Gulf shore, varying in population from one to two thousand inhabitants.

As nearly all I will say about Pass Christian applies equally to the other resorts, I will content myself, for the present, with mentioning the advantages of the beautiful little town in which I have resided for the past twenty-three years. In so doing, I will attempt to answer the several test questions previously mentioned in this article, and endeavor to prove that this section is as worthy as any in the United States, of the consideration and favor lavished on many other health resorts, both by the profession and by the laity.

Pass Christian claims a resident population of about two thousand, nearly all Americans. Although in a different State, it shares with its neighbor—the town of Bay St. Louis—the honor of being considered a suburb of New Orleans, the metropolis of the South. This city, during the summer, swells the population of these towns to double their number. It lies on the Louisville and Nashville Railroad, at a distance of fifty-eight miles from New Orleans, and eighty-four from the city of Mobile. Both these cities can be reached twice a day by the cars within two and one-half hours.

It enjoys a refined society, several churches, and schools, an institute for young ladies ably conducted, and a shell road five miles long, running parallel to the Gulf Coast, within a few paces of it, offering one of the smoothest and most delightful drives in the country. The town proper is also about five miles long, and composed of two streets running parallel to each other. It is built upon the dorsum of a ridge, which, by its natural declivity, offers the most perfect drainage. Immediately behind the town, and at a distance of barely a quarter of a mile, lies a pine forest, which extends hundreds of miles in depth. This shelters the town from the cold north winds, and constantly fills the atmosphere with a balmy aroma, which in reaching us becomes charged with the iodine, bromine, and saline particles wafted by the soft and gentle sea breeze. Its average temperature in summer is 85° —in winter 70°—thus showing no extremes of heat or cold. But for an occasional "norther," which is neither severe nor of long duration,

no one need fear the changes of our climate, and, if felt at all, an additional wrap is all that is necessary to insure perfect comfort. The rains are neither frequent nor protracted, very seldom lasting more than an hour, and such is the porosity of the soil that in three-quarters of an hour after a shower, pedestrians can take their usual exercise without fear of wet feet. The atmosphere is positively free from malaria. The sewerage, drainage, and water supply of the town are unsurpassed. There are several artesian wells of a depth of 500 feet. The death-rate per 1000 inhabitants varies between 3 and 4—that is, we witness from 6 to 8 deaths a year. All over this section of the country the Gulf Coast is looked upon as the healthiest spot in the United States, and it has been a matter of great astonishment that no one has as yet undertaken to write fully of its advantages as a winter resort. Perhaps because it lies so near home, and "nothing good" is expected "to come out of Nazareth!"

In my long residence, I can say without fear of contradiction, that never have I seen consumptives come here in the winter who did not return improved—especially those in the first stages of the disease. Most of those who have tested the climate of the Pass usually return, in spite of being differently advised by friends or physicians who know nothing of the health of this section. Bronchitis, asthma, laryngitis—in fact, all cases of trouble connected with the air-passages—improve rapidly, as do all cases of chronic malarial toxæmia. It is not claimed that this climate will *cure* consumption—let that be distinctly understood—but it is asserted that all who come to spend their winters here, return to their northern homes improved beyond the expectation of their friends and physicians. The best time to reach here is in October or November, and return as late as May in the spring.

We claim one of the finest hotels—the "Mexican Gulf"—in the whole country, supplied with all modern improvements and with a flowing well—depth 500 feet—affording the most abundant supply of water (75 gallons per minute), pure and clear as any in the world—capable of accommodating some 250 guests, and well patronized every winter by northern visitors. There are also quite a number of good boarding-houses, the rates of which are more than reasonable, and many private cottages that can be rented for moderate sums by the month or year. There is an abundance of game in the vicinity, offering many inducements to those whose health permits the enjoyment of such sportive recreations. Invalids, on an average, can remain eight or nine hours out of doors during the day, and we average six pleasant

days in the week, giving one all the time necessary to enjoy outdoor exercise, or to ride out in the piny woods.

Our roses are so abundant and beautiful that Northerners do not cease admiring them, and are constantly seen on their return to their quarters loaded with immense bouquets, either gratuitously obtained, or for such modicum that nobody minds the trifling expense.

I regret time does not permit me to write more about this Gulf Sound, which I have dared surname the Mediterranean of America, and, as I truly believe, deservedly. Many of my Northern colleagues, who have come here with invalid friends, or in quest of their own health, will certainly bear me out in all the assertions I have brought forward in connection with this lovely, healthy, and comparatively unknown Gulf Coast. I bring this article to a close, feeling persuaded that ere long this whole littoral will become thoroughly known, its climatic and health advantages thoroughly appreciated, and will enjoy as enviable a reputation as some other resorts have of late years—with the only difference, that when once known this shore will ever remain popular, because the facts adduced in its faver are incontrovertible, and the people of the United States are weary of being humbugged by the myriads of costly advertisements claiming for certain health resorts advantages which they are far from possessing.

Finally, in closing, I earnestly take pride in recommending to the whole of my profession their sending to us, with the positive assurance that they will never regret it, their invalid friends suffering from any of the following classes of ailments:

Consumption—early stages. Bronchitis—chronic. Laryngitis—chronic. Asthma—especially the idiopathic form. Nasal catarrh; all cases of neurasthenia, due to whatever cause; of malarial toxæmia; of anæmia or chlorosis; of neuralgia and rheumatism; and of all chronic uterine or intestinal troubles.

AN INVALID'S DAY IN COLORADO SPRINGS.

By S. E. SOLLY, M.D.,
OF COLORADO SPRINGS.

One of the many difficulties that are encountered by the physician who endeavors to select the best climate for the patient whom he desires to send from home, is the imperfection of the meteorological data at his command. Assuming that he can obtain a record of thermometric and barometric means, of mean velocity and direction of wind, of mean relative humidity, and of total precipitation, he is still very far from gaining a fair estimate of what weather his patient is likely to encounter during the hours of daylight. Yet this is precisely the knowledge most important to obtain. Provided that the house and its accommodations are sufficiently good, the change of climate during the hours of darkness is of very little consequence, comparatively, whilst the atmospheric conditions during the daylight hours are what should chiefly determine the choice of locality. It is with a view of giving this information concerning Colorado Springs, that this paper is presented. I fear, however, that after this preamble, the information being so meagre and imperfect, the oft quoted "Parturient montes, nascitur ridiculus mus" will appear peculiarly appropriate, to typify this labor of the Rocky Mountains. Our means of recording a sufficiency and continuity of observations have been, until recently, so poor, that I am unable to contribute more than a fragment to the stock of information concerning an invalid's day in Colorado Springs. The demand for this knowledge is, however, so pressing, that I feel no apology is needed for giving the best at my command rather than waiting until the record is more worthy of your attention. We have within the last year obtained some self-recording instruments in addition to the ordinary ones in use; from these we expect great things; but as is generally the case with what is new, there have been various accidents which interfered with the taking of continuous and accurate observations. The evidence offered in the tables appended in support of the statements I shall make, is, in spite of the ability, accuracy, and

industry of the Chief of the College Observatory, Professor Loud, very inadequate to support them.

Colorado Springs, a town of some eight thousand inhabitants is situated upon a plateau, 6022 feet above sea level, lat. 39, long. 105. It is about five miles from the foot-hills in which the eastern slope of the Rocky Mountains terminate, and from which the great plains stretch eight hundred miles east to the Missouri River, south to the Gulf of Mexico, and north to the Black Hills. The plateau upon which it is situated is surrounded on three sides by mountains and hills, but lies open to the plains in its southern and southeasterly aspects. The barriers from the wind and weather that this semicircle just described affords, being an average distance of four miles from the edge of the plateau upon which the town is spread, do not detract from its openness, or free exposure to the sun. Pike's Peak, lying to the west, robs it of the direct effect of the last beams in setting but gives a longer twilight than is usual on this continent. The value of this semicircle as a protection from storms is especially in the attraction it affords to the clouds that form upon the Peak, drawing the storms along its ridges to the northeast on one side or the southeast on the other, and thus frequently leaving the plateau free from the rain or snow that forms upon the mountains. The surface of the town site is almost flat with a gradual slope to the South, standing from seventy to twenty feet above the water-courses. There is a top soil of two feet below which are sand and gravel to an average depth of sixty feet, where lies a clay bed which follows the southward trend of the top soil. The soil is, therefore, very dry, nothing but buffalo grass growing without irrigation. The natural drainage is perfect. Water for domestic purposes is brought from the mountains in iron pipes. Trees, shrubs, flowers, and lawns have been planted, and thrive freely with the aid of irrigation. I have divided the invalid's day into the four seasons, in which the hours comprising the day vary as follows, viz., winter day, 9 A. M. to 4 P. M.; spring, 9 A. M. to 6 P. M.; summer, 8 A. M. to 7 P. M.; autumn, 9 A. M. to 5 P. M.; these arbitrary limits being about the average periods during which the invalids are usually out of doors. I will now proceed to sketch in outline the average day in midwinter.

After a night in which there has been a hard frost and a clear sky, with a light breeze from the north, and during which the invalid has usually slept soundly under several blankets, with his window partly open, he wakes up to find the sun shining into his eastern window. And this is a feature which, whatever the weather may be later in the day, is rarely absent. After breakfast, our invalid steps into the

street, being then in an atmosphere in which the heat in the sun is 92° F. and in the shade 30° F. A gentle air is stirring from the northeast at the rate of eight miles an hour. The mean dew point is 18.

As the day proceeds the temperature rises to its highest point, between 2 and 3 P. M., being 100° in the sun and 40° in the shade, while the wind, which has veered rapidly from the north to the south, blows with its highest daily velocity, of thirteen miles an hour. After 2 P. M. the wind works back again toward the east, being at sundown northeast, and continuing as darkness falls, to shift back to the northern quarter, whence it blows from 8 P. M. to 9 A. M., its velocity dropping to between seven and eight miles an hour; the temperature of the air at the same time falling from three to four degrees. The ground is usually bare of snow, no rain falls from mid-September to mid-April, and the sun shines unobstructed by clouds. During the three winter months, the cloudy days do not average more than three a month. The effect of such an air is bracing and genial, and being so dry the cold in the shade is very little felt; a medium weight of wrap being all that is needed. The roads are good, and seldom obstructed by snow or mud, and the neighboring hills and plains are full of interesting points to visit, and pleasant sheltered nooks where the invalid can rest under the agreeable heat of the sun, and eat his midday meal without fear of taking cold. The mean rain and melted snow fall combined, for ten years, is 15.87 inches; of this, about twelve inches fall in the spring and summer, leaving about four inches precipitation to occur between September and March. It, therefore, follows that the fall of snow is infrequent and scanty through the winter. Owing to the dryness and porosity of the soil, and the dryness of the air, with the warmth of the almost constant sunshine, the evaporation of the snow is very rapid. In looking at the temperature record it will be noticed that once or more during the winter the temperature will drop below zero, and sometimes a long way below. Such temperatures rarely last, especially during the day, as the sun so seldom fails to shine. When such cold weather occurs during the day, the wind, instead of taking its usual daily course from the north to the south through the eastern quarter, remains in the north, but has a small velocity, a high wind and low temperature being rarely in conjunction. On these exceptional days, the younger and more vigorous invalids go out to exercise with benefit, but the more delicate remain indoors, bearing their captivity with grace, as something that occurs to them only three or four days in the whole winter. Driving is most desirable in the morning, as there is usually very little

wind, but after lunch a strong breeze from the southeast is not uncommon, making walking or riding more pleasant.

In winter, as indeed throughout the year, there is more or less mobility of atmosphere, an absolutely still air being exceptional, but there is seldom in winter sufficient wind to make exercise disagreeable or dangerous, and on the majority of winter days delicate invalids sit out on their porches with pleasure and benefit. Table IX., of comparative velocity, shows that the total annual movement is moderate. And the mean velocity for the year, as shown in Table VI., only 8.58. Table VII. exhibits the mean diurnal variation of wind for a given month, but which is found to be correct for the whole year, the fact being that we have a night wind from the mountains, and a day wind from the plains. We are, as it were, upon a seashore, the plains being the ocean, and the mountains the shore, with a land and sea breeze. The mean direction of the wind at night is north; during the day it is from the south. There occurs once or twice in winter a strong warm west wind which is very apt to follow snow, and to remove it with great rapidity. It is called the "chinook," and is a similar wind to the "Fohn," of Europe, coming, probably, from the Pacific Ocean, and crossing the range. A study of this wind is extremely interesting, but space will not permit its discussion here. The spring weather in Colorado, as in most climates, is the least desirable; during late March and early April the chief part of what snow we have falls, and the wind that goes mainly to swell the total of the annual movement occurs. The "Chinook" is apt to blow occasionally during these months. Early March is generally pleasant. However, even in this season, there are seldom more than two or three days at a time when the delicate invalid cannot go abroad with benefit; and this will not occur more than a few times. The mornings are generally open for exercise, even when the afternoons are blustery. The Spaniards are credited with saying that "a bad Spaniard makes a good Portuguese," so, ruling out the two or three especially bad days, a bad Colorado spring day might be said to make a good spring day elsewhere. There is no regular thawing season, as in the Swiss mountain resorts. During the summer afternoons, thunder showers, lasting twenty minutes or half an hour are common, and it is by these that the bulk of the annual rainfall is made up. The mornings and evenings are rarely anything but bright and pleasant. There is usually during the summer, a week or ten days when it is hot even in the shade, but it is never, even then, equal to the depressing heat on the Atlantic seaboard. During the average summer day the heat, though always scorching under the direct

rays of the sun, if the head is protected, owing to the dryness, is not exhausting; and the shade under the numerous trees is cool and pleasant. A hot night, preventing comfortable sleep, is extremely rare. The absence of dew permits all but the most delicate invalids to sit on the porches in the evening with enjoyment. The autumn weather is peculiarly delightful, being dry and bright, with a pleasant temperature, and very occasional rain or snow. It is almost impossible for those who have never spent a few days at least, in comfortable quarters, at an altitude similar to this, to realize how both great heat and cold are so little felt; and how the great contrast between day and night, sunshine and shadow, is experienced without danger, and what exhilaration and health are given by the bright sparkling air. In short, the reply of a former governor of Colorado to an inquiry concerning the air of Colorado, though apparently bombastic, is scarcely untrue, "Sir, it is elixir to the breath, and velvet to the cheek."

I will not here discuss for whom the climate of Colorado is or is not suitable, but it must be evident from such a presentment of its meteorology that it is very positive in its qualities; is as potential for evil as for good, and that there is no climate where prudence and experience are more needed to realize its benefits, and guard against its dangers. The weather tables which follow, have been kindly compiled at my request, with great accuracy and labor, by Prof. Loud, Chief of the Colorado College Observatory, and by Mr. Sherwood, in charge of the Government Signal Station. The first series, Tables I. to V., relate especially to the Invalid's Day, and the tables, VI. to XV., which follow, to the General Meteorology.

The Invalid's Day.

In the table of "Principal Meteorological Elements," the columns headed A contain monthly means for *all the days* of the respective months. The columns headed B show the effect upon these means of the omission of five days of each month. Thus under "mean temperature" in column B are given the means for all but five days of each month of summer or winter, the omitted days in summer being the five warmest and in winter the five coldest days. All t mperature-means in this table are derived from eye-observations, the thermometer being observed at 7 A. M., 2 P. M., and 9 P. M., and the daily mean obtained by the formula $\frac{1}{4}[7 + 2 + 9 + 9]$.

Under "Relative Humidity," column B contains the mean of the remaining days of each month, after omitting the five on which the relative humidity was highest; while under "Dew Point" column B shows the result on the mean dew point of omitting the *same* days which were omitted in the "Relative Humidity" column, *i. e.*, the five moistest days, as estimated by their relative, not their absolute, humidity.

The "days of rain or snow" are those on which the total precipitation (rain or melted snow) was not less than one-hundredth of an inch.

Clear days are those in which the amount of cloud is three-tenths or less of the whole sky-surface; cloudy days those in which this amount is eight-tenths or more; other days are *fair*.

The mean velocity of wind, given in miles and tenths, is the mean of all the hours of each month.

TABLE I.—PRINCIPAL METEOROLOGICAL ELEMENTS FOR THE YEAR MAY 1, 1886, TO APRIL 30, 1887.

1886.	Mean Temperature.		Mean Dew Point.		Mean Rel. Humidity.		Total precipitation.	Days of rain and snow.	Number of days			Barometer at 2 P. M.	Wind. Mean velocity.
	A	B	A	B	A	B			Clear.	Fair.	Cloudy.		
May	62.5	.....	31.1	29.2	34.1	23.2	0.12	3	18	11	2	24.036	9.8
June	64.4	63.2	47.7	46.8	56.9	52.7	3.06[1]	13	13	12	5	24.073	8.3
July	71.8	70.4	50.1	48.7	49.8	44.2	2.91	13	13	13	5	24.128	7.4
August	68.9	67.6	54.1	53.4	61.2	58.0	1.39	12	11	11	9	24.115	7.1
September	59.4	.....	36 0	33.9	47.8	43.0	0.33	3	18	8	4	24.054	8.9
October	50.6	.....	28.7	27.2	46.6	41.8	0.28	5	18	7	6	24.049	9.4
November	32 9	.....	.....	.....	.....	.....	0.19	1	15	8	7	23.964	10.6
December	33.5	35.7	20.1	19.6	61.3	56.0	0.16	3	15	9	7	23.975	9.3
1887.													
January	29 9	33.9	.....	.....	.....	.....	0.06	2	14	17	0	23.816	11.7
February	31.1	34.3	16 5	16 5	60.1	53.9	0.32	3	12	10	6	23.851	10.8
March	43.4	.....	18.5	17.6	42.4	36 0	0.19	2	9	17	5	24.001	9.5
April	56.7	.....	26.2	24.8	52.2	44.8	1.54	9	8	12	10	23.909	10.8

[1] On June 2, 1886, some rain, probably not much, was lost by the overflow of the gauge. The precipitation for January, 1887, is estimated, but there can be very little error.

During cold weather in November, 1886, and again in January, 1887, humidity observations were suspended for a week or more each time, so that no means are computed for these months. Their true humidity would probably have been found to be not far from 60 per cent.

TABLE II.—TEMPERATURE OF THE AIR DURING THE WARMER HOURS OF THE DAY, AS DERIVED FROM THE RECORD OF THE DRAPER SELF-REGISTER.

	Number of dates recorded.	8 A. M.	9 A. M.	10 A. M.	11 A. M.	12 M.	1 P. M.	2 P. M.	3 P. M.	4 P. M.	5 P. M.	6 P. M.	7 P. M.	Mean of "Invalid's day."
January, 1886,	29 to 31	...	19.7	23 3	26 9	29.2	31.1	32.6	31.5	31.0	.....	... ..	.....	28.2
February, 1887,	25 to 27	...	30.3	34 4	37.5	40.1	42.3	44.3	44.2	44.7	.....	.....	.....	39.7
March, "	13 to 15	...	41.5	44 1	45.9	48.0	49.7	52.0	54.5	53.6	52.6	50.5	.....	49.2
April, "	24 to 26	...	46.6	48.9	50.7	52.4	52 9	54.4	53.6	54.0	53.6	52.1	.....	51 9
May, "	20	...	57.0	59.1	61.4	63.2	64.3	64.8	64.7	65.2	64.4	63.2	.....	62.7
June, 1886,	12 to 15	65 7	66.7	69.1	71.8	73.1	74.3	74.4	74.3	74.3	73 6	72.5	71.2	71.8
July, "	29 to 30	73.8	75 2	77.5	79.3	80.5	81.7	81 5	80.7	79.9	78.7	77.4	75.1	78.4
August, "	29 to 31	68.0	71.0	74.0	76.2	77.5	77.9	78.7	78.7	76.9	75.4	74.0	71.5	75 0
September, "	27 to 30	...	62.6	66.3	68.6	70 6	72.0	72 2	72 4	71.8	70.8	.....	.....	69.7
October, "	29 to 31	...	52 2	55.4	58.8	61.3	62.8	64.1	63.8	63.3	61.0	.....	.....	60.3
November, 1885,	29 to 30	...	41.2	45.2	48.3	50.6	52.2	52.8	53 4	52.9	49.6	.. ...	.....	49.6
December, 1885,	30 to 31	...	31.2	37.4	40.4	43.0	44.7	45.5	45.7	44.4	.....	.....	.....	41.6

The data for March begin with the 17th, and those for June with the 11th. For May they end with the 20th, the day before the date of compilation. Gaps of less consequence, usually extending over a few hours only, occur in the other months, as indicated in the column "Number of dates recorded."

TABLE III.—SUN-TEMPERATURE.

1. *Average number of hours, and tenths, during which the pencil of the Draper Self-registering Sun-thermometer remained above the mean line of the chart, from March to September,* 1886.

	March.	April	May.	June.	July.	Aug.	Sept.
Average number of hours . .	4.8	2.3	5.8	3 7	5.6	4.9	4.1
Number of days in record . .	31	16	30	18	27	26	25

2. *Temperatures indicated by the mercurial sun-thermometer* (*blackened bulb* in vacuo) *during the year June,* 1886–*May,* 1887.

	June	July.	Aug	Sept	Oct.	Nov	Dec	Jan.	Feb	Mar.	April.	May.
Highest temp.	137°	155°	152°	135°	124°	110°	112°	123°	114°	121°	124°	129°
Lowest temp	110	138	133	118	104	94	97	95	101	108	98	101

The figures in the last line are not averages, but are determined as nearly as possible so that each has, in its own month, as many of the observed temperatures above it as below it.

Table IV.—Direction of Wind during the Warmer Hours of the Day, as derived from the Self-registering Anemoscope.

Showing the number of times the wind's mean direction was registered in each of eight points of the compass, during an hour of the "Invalid's Day"—that is, from 9 *to* 4 *o'clock in winter,* 9 *to* 6 *in spring,* 8 *to* 7 *in summer,* 9 *to* 5 *in autumn, for the year June,* 1886–*May,* 1887.

1886.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Direction not registered.	Total.
June	4	15	11	39	51	11	7	4	218	360
July	22	34	16	76	69	14	7	10	124	372
August	16	32	12	70	41	28	10	8	155	372
September	33	24	9	124	12	1	21	10	36[1]	270
October	25	19	9	148	23	14	10	18	13	279
November	37	26	15	85	17	9	19	51	11	270
December	22	49	8	86	25	6	10	29	13	248
1887.										
January	39	20	6	67	18	13	39	35	20	248
February	9	20	8	22	85	23	22	26	9	224
March	24	21	7	80	32	11	19	16	100	310
April	20	7	3	73	6	22	10	25	134	300
May	27	11	3	120	26	3	6	4	....[1]	310
Total	269	268	107	990	405	155	180	236	943	2766

Table V.—Mean Wind-movement in Miles per Hour, for the year 1886, from the Anemometer Self-register.

	A. M.				P. M.						
	8–9.	9–10.	10–11.	11–12	12–1.	1–2.	2–3.	3–4.	4–5.	5–6	6–7.
January	...	8.5	8.5	9.4	9.7	12.7	15.8	13.0			
February	...	7.4	7.6	9.8	12.2	11.3	13.3	16.0			
March	...	9.9	12.3	12.8	13.5	12.9	14.0	13.2	14 1	13.9	
April	...	8.9	9 4	11.3	22.2	12.8	13 7	14.4	14 9	14.6	
May	..	7 0	9.0	10.3	11.4	12.1	12.1	11 8	11.8	11.4	
June	5.0	5 4	6.2	9.4	10.7	10.9	12.5	11.1	9 7	9.1	8.9
July	6.5	6 5	6.8	7.0	8.0	8.4	8.5	9.4	12.0	10.2	8 5
August	3.3	4.0	5.0	6.4	8.9	10.0	10.4	9 8	7.9	9.9	9.6
September	...	6.9	10.0	11.1	11.4	10.6	12.1	13.5	12.5		
October	...	5.7	7.7	7.4	6.3	8.4	9.7	8.8	11.1		
November	...	12 5	11.2	11.2	11.4	12.2	11.9	12 2	12.5		
December	...	9.9	8.7	9.0	9.2	9 3	11.0	11.0			

[1] The record of September, 1886, was continuous from the 5th to the end of the month, that for May, 1887, from the beginning to the 20th. The data were compiled May 21st.

General Meteorology.

Table VI.—Mean Temperature.

	At 7 A. M.	At 10–8 A. M.	At 2 P. M.	At 9 P. M.	Day.[1]
January	17.8	27.3	36.0	20.9	24.4
February	21.3	36.3	42.0	27.1	29.4
March	31.4	46,6	52.4	37.4	36 6
April	38.9	50.8	54 7	42.2	43.9
May	50 2	57.9	62.9	51 7	49.9
June	61.5	66.1	72.6	60.2	65.9
July	66.2	75.2	77.6	65.0	67.7
August	64.9	74.3	76.9	63.6	68.1
September	50.1	60.4	68.8	54.2	57.2
October	37.9	52 0	60.6	42.7	47.8
November	27.9	43 9	48.2	31.3	35 5
December	20.2	22.8	38.2	23.2	27.6
Spring	40.2	51.8	56 7	43.8	42.8
Summer	64 2	71.9	75.7	62.9	67.9
Autumn	38.6	52.1	59.2	42.7	47.1
Winter	19.8	28.8	38.7	23.7	27.1
Year	40.7	51.1	57.6	43.3	46.4

Table VII.—Maximum and Minimum Temperatures in Winter and Spring.

Maximum temperatures.

	1873–74.		1874–75.		1875–76.		1877–78.		1878–79.		1879–80.		1880–81.		1882–83.	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
December,	65.0	44.1	59.0	41.7	67.0	51.6	69.0	.....	59.5	31.2	.....	...	.....	.....	.....	.....
January,	63 0	46.6	60.0	35 1	62.0	45.5	59.5	.....	68.0	37.6	62.5	46.4	63.0	40.5	55.5	36.8
February,	59.0	40 2	58.0	40.8	64.0	51.6	61.5	47.1	68.5	47.1	61.0	39.1	60.0	47.6	62.0	.....
Winter,	65 0	43.6	60.0	39.2	67.0	49.6	69.0	.....	68.5	38.3	.....	.....	.....	.....	.....	.....
March,	61.0	48.2	67.0	42.0	65.5	49.1	70.5	.....	77 0	59.4	.....	.....	70.0	51.3	67 5	54.9
April,	82.0	53 6	71.0	.....	79.0	60.8	72.0	60.4	.....	.....	.....	.....	73.5	.....	70.5	56.6
May,	92 0	74.7	84.0	70.3	84.0	67.6	80.0	65.1	.....	.....	.....	.....	.....	.....	80.5	66.4
Spring,	.....	58.8	.....	.....	.....	59.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	59 3
June,	101.0	85.6	91.0	82.2	93.0	77.2	84.0	71 5	.....	.....	.....	.....	.....	.....	90.5	76.5

Note.—Column A contains the highest temperature of the month or season; column B the mean of the highest temperatures of the several days.

Minimum temperatures.

	1873–74.		1874–75.		1875–76.		1877–78.		1878–79.		1879–80.		1880–81.		1882–83.	
	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D
December,	– 9.0	10.6	– 4 0	15.1	3.0	21.2	–2.0	.....	–15.5	5.6	.....	.....	.....	.....	.....	.....
January,	–15.0	14 6	–25 0	3.2	–3.0	12.3	–5 0	.....	–18.0	6.5	–15.1	16 1	–14.0	11.3	–25 0	6.8
February,	–17.0	11.6	– 8.0	16 1	–1.0	18.8	7.0	19.6	– 9.5	19 8	–20.5	9.9	3.0	17 3	–20.0	4.7
Winter,	–17 0	11.9	–25 0	11.5	–3 0	17.4	–5.0	.....	–18.0	10.6	–20.5	.....	–14.0	.....	25.0	.....
March,	1.0	19.8	– 4 0	16.8	3.0	18.4	13.5	.....	12.0	28.6	.....	.....	– 9.0	24.0	6.0	24.2
April,	5.0	23.5	6.0	27.9	7 5	30 9	20.0	33.8	.....	.....	.....	.....	15 0	.....	19.0	31.0
May,	27.0	41.7	26.0	42.0	26.0	40.4	30.0	40.5	.....	.....	.....	.....	.....	.....	26.0	38.4
Spring,	.....	28.3	.....	28 9	.....	29.9	....	.....	.....	.....	.....	.....	.....	.....	.....	31.2
June,	39.0	50 7	32.0	49.7	37.0	46.7	42.0	49.0	.....	.....	.....	.....	.....	.....	33.0	46.9

Note.—Column C contains the lowest temperature of the month or season; column D the mean of the lowest temperatures of the several days.

[1] The daily mean is one-fourth the sum of the readings at 7 A. M., at 2 P. M., and double the reading at 9 P. M.

Table VIII.—Maximum and Minimum Temperatures in Summer and Autumn.

	1874.				1875.				1878.			
	A	B	C	D	A	B	C	D	A	B	C	D
June	101.0	85.6	39 0	50.7	91.0	82.2	32.0	49.7	84.0	71.5	42 0	49.0
July	98.0	89.5	48.0	55.5	90 0	76 4	47.0	53 1	90 0	83.2	48 5	57.0
August	92.5	85 5	52.0	55.4	93 0	79 7	42.0	51 6	92 0	81 5	50 0	58.3
Summer	101.0	86 9	39 0	53.9	93 0	79.4	32.0	51.5	92 0	78 7	42 0	54 8
September	87 0	71.0	27 0	42 4	88 0	73.7	27 0	44.9	82 0	69 9	33 5	43 0
October	76 0	63.1	20 0	38 6	82.0	68 7	18.0	35 9	79.0	61 7	13 0	32 1
November	65.0	52.6	2 0	24.4	74 0	52 3	9.0	24.2	66 0	51.5	5 5	25 7
Autumn	...	62.2	...	35.1	...	64.9	.....	35 0	.....	61 0	.....	33.6

Note —Column A contains the highest, and column C the lowest, temperature of the month or season; column B contains the mean of the highest, and column D the mean of the lowest, temperatures of the several days.

Table IX.—Effect upon the Monthly Means of the Omission of Five Days of Extreme Temperature.

	Cold Months.					Warm Months.			
	All the days.		All but five.			All the days		All but five.	
	Mean Thermometer.	Mean of Minima.	Mean Thermometer	Mean of Minima.		Mean Thermometer.	Mean of Minima.	Mean Thermometer.	Mean of Minima.
November,	35.9	24 7	38.8	27 6	May,	54.1	70.1	51 9	67.8
December,	24.2	14 0	27.2	16.8	June,	63.7	79 8	62 2	77 7
January,	24 3	8 0	28 2	11.9	July,	68 4	83 0	67.1	81 6
February,	31 5	15.9	34.5	20.0	August,	67 8	82 3	66 6	80 7
March.	39 7	21.4	42 1	24.1	September,	56.8	71.5	55 0	69.1

Table X.—Cloudiness and Rainfall.

	Average number of days			Mean monthly rainfall	Total rainfall.	
	Clear.	Fair.	Cloudy.			
					Spring.	
January	19	9	3	0.17	1872	6.79
February	15	11	2	0.20	1873	2.91
March	15	12	4	0.68	1874	9 95
April	13	13	4	1 23	1875	2 45
May	11	13	7	2 65	1876	4.98
June	13	12	5	1.87	1879	4 39
July	14	14	3	3.65	1883	2 55
					Summer	
August	13	13	5	2 40	1872	10.81
September	20	8	2	1 78	1873	10 46
October	24	6	1	0.29	1874	1.92
November	19	8	3	0.52	1875	10.28
December	18	9	4	0.43	1878	8.24
					Fall and Winter	
Spring	39	38	15	1.52	1872–3	1.11
Summer	40	39	13	2.64	1873–4	3.10
Autumn	63	22	6	0.86	1874–5	4.86
Winter	52	29	9	0 27	1875–6	4 15
Year	194	128	4	1.32	1878–9	4 80

Note.—The "rainfall" includes melted snow

Table XI.—Wind.

Proportionate frequency of winds from the several points of the compass.

	At 7 A. M.								At 2 P. M.							
	N	NW	W	SW	S	SE	E	NE	N	NW	W	SW	S	SE	E	NE
January	44	31	11	2	0	3	4	5	25	18	4	1	8	31	9	4
February	42	26	6	1	3	4	3	15	20	9	12	8	12	27	6	6
March	36	20	7	2	2	9	4	20	5	9	15	7	18	37	4	5
April	32	26	8	9	3	10	4	8	14	13	14	11	15	26	2	5
May	38	17	3	2	13	15	6	6	10	14	7	9	25	28	3	4
June	33	17	1	8	11	11	7	12	10	8	0	5	18	47	6	6
July	36	40	2	0	4	10	2	6	7	10	7	11	13	32	13	7
August	45	21	4	0	8	9	0	13	12	28	5	3	13	22	10	7
September	38	41	1	3	0	6	0	11	4	14	4	10	8	45	7	8
October	55	28	3	1	4	1	4	4	6	6	5	6	24	39	13	1
November	55	28	5	2	2	5	2	1	21	12	6	4	11	34	10	2
December	48	33	7	1	3	3	3	2	20	14	7	3	13	39	2	2
Year	42	27	5	3	4	7	3	9	13	13	7	6	15	34	7	5

	At 9 P. M.								Mean velocity, miles per hour.
	N	NW	W	SW	S	SE	E	NE	
January	35	31	11	1	4	4	3	11	9 74
February	22	22	18	3	2	12	4	17	10 30
March	16	32	9	2	6	16	9	10	10 06
April	30	20	9	8	7	10	7	9	11.69
May	26	17	11	5	11	16	7	7	9.82
June	21	30	10	3	7	17	5	7	8.33
July	17	29	6	10	8	13	4	13	6.77
August	32	36	9	0	3	12	3	5	6.37
September	34	30	8	1	11	9	5	2	7 48
October	40	33	5	5	2	9	3	3	7.31
November	37	45	2	2	4	4	2	4	7.93
December	39	32	9	3	1	13	3	0	7.10
Year	29	30	9	4	5	11	5	7	8.58

Table XII.—Mean Diurnal Variation of Wind in Velocity and Direction, March, 1883.

Time.	Velocity.	Progress.	Direction
Midnight to 2 A. M.	8.7	6.1	N. 17° 9′ E.
2 A. M. " 4 "	8.5	5.8	N. 11 3 E.
4 " " 6 "	9 6	7.7	N. 11 56 E
6 " " 8 "	8.4	6.8	N. 6 18 E.
8 " " 10 "	6.9	3.9	N. 24 32 E.
10 " " 12 M.	10.4	4.6	N. 79 47 E.
12 M. " 2 P. M.	12.5	6.1	S. 61 25 E.
2 P. M. " 4 "	12 5	6.4	S. 52 54 E.
4 " " 6 "	11.3	4.9	S. 60 14 E.
6 " " 8 "	6.6	2.6	S. 69 43 E.
8 " " 10 "	7 6	2.4	N. 62 19 E.
10 " " midnight	8.2	3.3	N. 46 51 E.

Table XIII.

	Elevation.	Barometer.	Mean of 5 years. Number of days			4 years.	10 years.		Prevailing winds.
	Feet.	Inches.	Clear.	Fair.	Cloudy.	Relative humidity.	Yearly rainfall.	Mean temperature.	
Colorado Springs,[1]	6050	24.06	194	128	43	.....	15.87	46.4	N and SE.[2]
Denver, Colo.	5294	24 77	177	142	46	45.8	14 77	49.1	S.
Santa Fe,	7046	23.26	174	148	41	41.4	14 17	48.5	E and SW
Los Angeles,	350	29.64	164	148	51	65.8	18.97	59.8	
Salt Lake,	4348	25.60	141	131	93	40.3	17.52	51.8	NW and SE.
Jacksonville, Fla.	43	30.03	126	152	87	69.0	55.94	69.2	
Augusta, Ga.	183	30.14	123	150	92	69.2	48.98	64.2	
Newport,	34	29.95	108	140	111	74.3	50.20	50.3	
Boston,	142	29.84	105	145	115	68.5	49.47	48.5	W.
Chicago,	661	29.31	104	154	107	69.2	35.47	49.3	SW.
St. Paul,	811	29.13	103	158	104	67.3	29.59	43.9	SE.
New York,	164	29.85	101	155	109	70.2	42.70	51.3	NW.

Table XIV.—Comparative Velocity.

Total annual movement.

Year—April, 1878, to March, 1879.

Colorado Springs	70,912

Year—January to December, 1880.

Cape May, N. J.	134,455
Milwaukee, Wis.	110,924
Philadelphia, Pa.	92,211
St Louis, Mo.	90,927
Boston, Mass.	85,704

Year—January to December, 1880.

Newport, R I.	84,885
San Francisco, Cal.	82,724
St. Paul, Minn.	76,096
New York, N. Y.	74,642
Chicago, Ill.	74,192
Jacksonville, Fla.	57,333
San Diego, Cal.	55,062

Table XV.

Davos Platz.	Clear.	Fair.	Cloudy.	Colorado Springs.	Clear.	Fair.	Cloudy.
October	11	12	8	October	24	6	1
November	14	7	9	November	19	8	3
December	16	8	7	December	18	9	4
January	19	9	3	January	19	9	3
February	16	8	5	February	15	11	2
March	18	7	6	March	15	12	4
Total	94	51	38	Total	110	55	17

The Davos observers divide the days into cloudless, constant sunshine, which I have grouped as coming under the head of clear in the Colorado observations. Clouds and sunshine, as fair; cloudy days, days when there were showers of rain or snow, wet or snowy days, all have been classed under cloudy days and compared. The Davos observations, which were all I could obtain, were for 1879, 1880, 1881, while the Colorado Springs figures are from several years' observations.

[1] The data for Colorado Springs are taken from the preceding tables, and the number of years' observations from which each is obtained is stated in the letter which accompanies them.

[2] North at night; S E in the middle of the day and afternoon.

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